Public (Redacted) Version

PTC Implementation Plan (PTCIP)

Submitted in fulfillment of FRA Regulations Part 236, Subpart I, Section 236.1011
April 16, 2010

Request for Confidential Treatment Pursuant to 49 C.F.R. § 209.11

The following is Canadian National Railway Company's Positive Train Control Implementation Plan ("PTCIP"), submitted in fulfillment of 49 C.F.R. Part 236, Subpart I, § 236.1011.

As authorized by 49 C.F.R. § 236.1009(e)(3), CN requests confidential treatment, pursuant to 49 C.F.R. § 209.11, for certain portions of the document on the basis that these portions contain: (1) sensitive security information as defined in 49 C.F.R. Part 15 ("SSI"), (2) confidential trade secrets or other proprietary commercial and/or financial information that are exempt from the mandatory disclosure requirements of the Freedom of Information Act, 5 U.S.C. § 552, and/or required to be held in confidence under the Trade Secrets Act, 18 U.S.C. § 1905, and (3) safety analysis records protected from public disclosure under 49 U.S.C. § 20118.

Information redacted as confidential includes tables, figures and narrative relating to (1) the installation risk analysis, such as risk factor levels, risk factor weights, and risk rankings; (2) line segment characteristics, including freight, passenger, and TIH/PIH volumes, and the track attributes; and (3) the sequence and schedule for deployment of the PTC system. These portions of CN's PTCIP contain sensitive security information the public disclosure of which would be detrimental to transportation safety and security. This information is also integral to the analysis of safety risks CN conducted in order to implement the PTC system in a manner that addresses areas of greater risk before areas of lesser risk, as required by 49 U.S.C. § 20157(a)(2). Finally, specific information regarding CN's routing of certain traffic, its operations, and the attributes of particular subdivisions and line segments constitutes confidential business information that, if publicly disseminated, could result in competitive harm.

In accordance with the requirements of 49 C.F.R. Part 15, CN has properly marked every page of the document and its appendices (including pages that do not contain SSI) to indicate that the document contains "SENSITIVE SECURITY INFORMATION." In addition, the document has been marked with the statement "CONTAINS CONFIDENTIAL INFORMATION," as required by 49 C.F.R. § 209.11(d).

CN is also submitting a redacted "public" version of the PTCIP in which all sensitive or confidential information has been removed. Because this version does not contain SSI or confidential material, it does not include the markings required by 49 C.F.R. § 209.11(d) and 49 C.F.R. Part 15. Finally, as specified by 49 C.F.R. § 236.1009(e)(3), to assist FRA in efficiently and correctly reviewing requests for confidentiality, CN is also submitting a version of its PTCIP which highlights the portions of the document that have been redacted from the public version. Because this version of the document contains SSI and confidential material, it has been properly marked with the designations referenced above.

CN requests that ***only*** the Redacted Version of the PTCIP be placed on the public docket or otherwise disclosed.

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1. Introduction

CN (Canadian National Railway Company and its operating railway subsidiaries), operates the largest rail network in Canada and the only transcontinental network in North America with approximately 20,421 route-miles of track. CN is a leader in the rail industry linking customers to all three NAFTA nations with a network that spans Canada, from Halifax in the east to Vancouver and Prince Rupert in the west; and runs through the heart of mid-America, from northern Minnesota to New Orleans via Chicago and Memphis. It is the only rail network on the North American continent to connect three coasts – the Pacific, the Atlantic, and the Gulf of Mexico.

CN's freight revenues are derived from seven commodity groups representing a diversified and balanced portfolio of goods transported between a wide range of origins and destinations. This product and geographic diversity better positions the Company to face economic fluctuations and enhances its potential for growth opportunities. In 2008, no individual commodity group accounted for more than 19 per cent of revenues. From a geographic standpoint, CN is equally well diversified. In 2008, approximately 31 per cent of freight revenues came from transborder traffic, 26 per cent from offshore traffic, 24 per cent from Canadian domestic traffic, and 19 per cent from U.S. domestic traffic.

Approximately 85 per cent of the traffic volumes handled by CN are originated along its network. This enables the Company to capitalize on service advantages and build on opportunities to efficiently use assets.

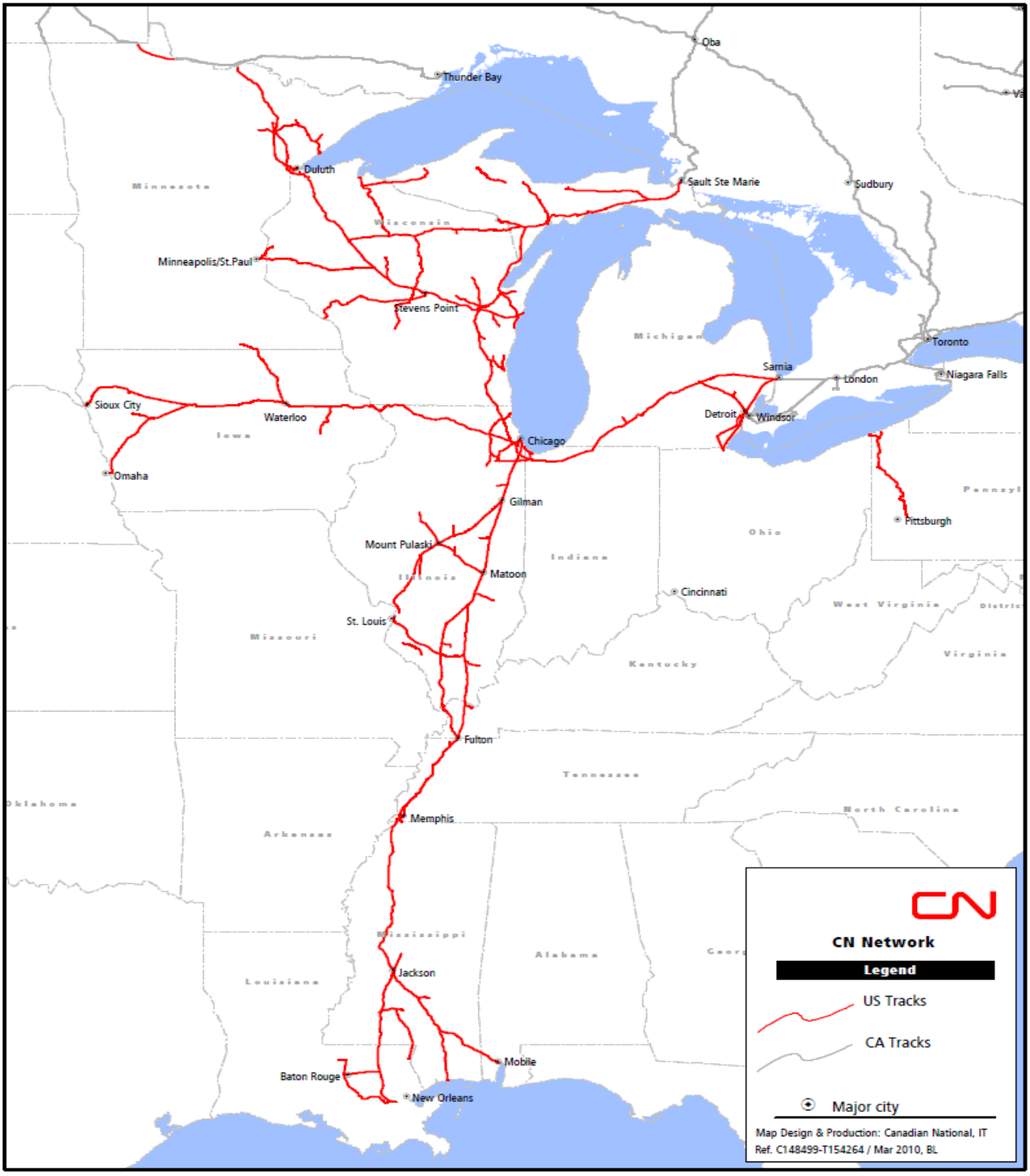
The primary focus at CN is to run a safe and efficient railroad. While remaining at the forefront of the rail industry, CN's goal is to be internationally regarded as one of the best-performing transportation companies. The company's business strategy is guided by five core principles: providing good service, controlling costs, focusing on asset utilization, committing to safety, and developing people.

CN's commitment is to create value for its customers by providing quality and cost-effective service; and for its shareholders by striving for sustainable financial performance through profitable growth, solid free cash flow and a high return on investment.

CN continues to invest in various strategic initiatives to expand the scope of its business. A key initiative is the recent acquisition of a major portion of the EJ&E, which will drive new efficiencies and operating improvements on CN's network as a result of streamlined rail operations and reduced congestion.

The map below illustrates the CN network in the United States.

Figure 1 CN Network Map



1.1. PTC Overview

This document provides an overview of CN's plan for implementation of Positive Train Control (PTC) in accordance with the mandate of the Railway Safety Improvement Act of 2008 (RSIA) and the requirements of the final rule published at 49 C.F.R. Part 236, Subpart I. The sections that follow this Overview address the following topics in greater detail:

a) how, where, and in what sequential order the PTC system will be deployed;

b) how the PTC system provides the statutory functionality;

c) whether the PTC system is defined for safety as non-vital, vital, stand-alone, or mixed under Part 236 criteria;

d) identification of all main line track segments, including the method of operation, the maximum authorized speed(s), route characteristics, and signal systems for each, and any MTEAs or RFAs;

e) the installation risk prioritization methodology used; and,

f) all exceptions to the established deployment and risk methodologies.

1.1.1. PTC Deployment

In compliance with the regulatory requirements defined in 49 C.F.R. § 236.1011(a)(4), CN is deploying PTC in areas of greater risk to the public and railroad employees before areas of lower risk. The risk assessment factors and weighting criteria used to rank and prioritize line segments are discussed in more detail in sections 7 of the PTCIP and Appendix B attached. The established risk ranking methodology was used with the risk factors as required in 49 CFR 236, Subpart I, § 236.1011(a)(5), to establish risk ratings for each CN subdivision where PTC is required.

CN is deploying PTC using a corridor based approach to minimize potential service impacts, maximize the efficiency of installation resources and optimize the utilization of PTC equipped locomotives. Installation and testing of the PTC system in a coordinated corridor oriented manner will help ensure safe operation as well as interoperability, and provide the information necessary to submit a PTC Safety Plan (PTCSP) as defined in 49 C.F.R. § 236.1015.

The aggregated summary risk ranking for all subdivisions within PTC deployment groupings of subdivisions was tabulated and used to determine deployment group priorities. The subdivision grouping with the highest priority is targeted for PTC deployment first. Scheduling of successive deployment groupings of subdivisions is based on the aggregate risk ranking as well as evaluation of other factors such as maximizing deployment efficiency, optimizing utilization of PTC equipped locomotives and minimizing potential service disruptions.

The map below depicts the 5 proposed PTC deployment groupings.

Figure 2 PTC Deployment Groupings

(Redacted Material)

1.1.2. Provision of Statutory Functionality

The Wabtec Railway Electronics (WRE) Vital Electronic Train Management System (V-ETMS) being implemented by CN is a locomotive-centric train control system that uses a combination of locomotive, office and wayside data integrated via a radio network and provides functionality which satisfies the requirements of the RSIA . Specifically the V-ETMS system provides the ability to:

- Alert train crews to pending authority and speed limit violations, including passing a signal at Stop
- Stop trains prior to exceeding authority and speed limits, including signals at Stop
- Interrogate wayside signals, switches and broken rail detection circuits in a train route when operating in V-ETMS territory
- Protect work zone limits by enforcing compliance with work zone restrictions

In addition to the functionality described above, the V-ETMS system is designed to support different railroads and their individual methods of operations. The system is designed for implementation across a broad spectrum of railroads without modification. This design approach supports interoperability across railroads as V-ETMS equipped locomotives apply consistent warning and enforcement rules regardless of track ownership. Design and development of V-ETMS has been supported by CSX Transportation Inc. (CSXT), Norfolk Southern Railway Company (NS), and Union Pacific Railroad (UPRR), as well as CN and other Class 1 railroads through the Interoperable Train Control (ITC) industry effort.

1.1.3. PTC System Definition

The PTC system being deployed by CN is the Wabtec Railway Electronics' V-ETMS system, a vital overlay system as defined in 49 C.F.R. § 236.1015(e)(2). V-ETMS is based on the Electronic Train Management System (ETMS) developed by WRE which has been approved by FRA under 49 C.F.R. §236, Subpart H for use in revenue service on BNSF Railway (FRA-2006-23687-21), subject to certain conditions. Additional details on the V-ETMS PTC system being deployed by CN are included in sections 3, 4 and 5 of this PTCIP as well as the accompanying PTCDP documentation.

1.1.4. EJ&E Acquisition

On February 1st, 2009, CN completed its acquisition of the principal lines of the Elgin, Joliet & Eastern Railway Company (EJ&E). As part of the PTC planning process, CN has included the acquired EJ&E assets and has applied the same PTC evaluation process to the acquired assets that has been implemented on all other CN tracks. Due to the date of the transaction and subsequent traffic re-routing, it has been determined that use of 2008 traffic volumes for Million Gross Tons (MGT) would be less representative of expected traffic volumes under CN operations than using 2009 traffic volumes pro-rated for a full 12 month period for the acquired EJ&E subdivisions (Matteson, Leithton, Lakefront, Illinois River). Therefore, we have used the 2009 traffic data for these segments. Toxic Inhalation

Hazard/Poisonous by Inhalation Hazard (TIH/PIH) traffic volumes included in the PTCIP are based on actual 2008 data and are slightly greater than 2009 volumes.

1.1.5. Main Line Track Segments

The CN US network includes 82 subdivisions of track that were reviewed to determine if they qualified as main line track segments under the RSIA and 49 C.F.R. § 236 PTC regulations. These subdivisions include all of CN's US operating network with the exception of tracks where all trains are limited to restricted speed within a yard or terminal area or on auxiliary or industry tracks.

Each of the 82 CN subdivisions were evaluated according to the main line track definitions in 49 C.F.R. § 236.1003 and § 236.1005(b)(1)(i and ii). Using the 5MGT and regularly scheduled commuter or inter-city passenger train criteria, there are 48 CN subdivisions that qualify as main line track segments. A discussion of this evaluation is included in Section 6 of this PTCIP.

Six of the 48 subdivisions that meet the main line track criteria, had no passenger train or TIH/PIH traffic (loads or residue) in 2008 and have therefore been eliminated from the CN PTC Implementation planning and weighted risk assessment process (see Section 6 for more details). One additional line segment handles exclusively passenger traffic at restricted speed (Redacted Material) and an MTEA request is included in section 6 for this segment of track. This leaves a total of 41 CN subdivisions and sections of subdivisions that are considered main line track requiring PTC and are discussed in further detail in subsequent sections of this PTC Implementation Plan.

(Redacted Material)

1.1.6. Installation Risk Prioritization Methodology

The risk prioritization model used by CN is a basic weighted score approach in which a number of risk factors were assigned integer scores corresponding with level of risk ranging from 0 (lowest risk) up to 5 (highest risk) for each of the CN subdivisions to be equipped with PTC. Each risk factor was also assigned a weight which provided an indication of the "relative importance" of the factor in determining the overall risk ranking. Equation 1 below shows how, for *n* risk factors, a relative risk score was generated for each subdivision by

multiplying the integer score assigned to the subdivision for a given factor (FR_i) by the weight assigned to that factor (FW_i), and summing the products of the n risk factors.

(Equation 1) *Relative Risk Score for Subdivisio* $\sum_{i=1}^{n} FR_i FW_i$

A summary of the risk prioritization model is provided in Section 7, and additional model details are provided in the Risk Prioritization Model report included in Appendix B.

1.1.7. Organizational Relationships

The PTC implementation team was organized to provide the highest level of Executive support and skilled, experienced leaders in every technical area of the project. Each level of the project team has clear roles and responsibilities and access to a wealth of knowledgeable resources within the organization.

1.1.7.1. Steering Committee

The Steering Committee's role is critical for the success of the project. Composed of CN executives from several functions of the organization, together they will provide guidance, contribute valuable input on implementation plans and roll-outs, and help resolve issues and remove any road blocks. They represent the Stakeholders and Sponsors and as such, will approve budgets and final deliverables.

- James S. Bright, VP and Chief Information Officer
- Keith Creel, Executive VP and Chief Operating Officer
- Sameh Fahmy, Senior VP Supply Management, Engineering and Mechanical
- Ghislain Houle, Vice-President Financial Planning
- Paul Miller, Chief Officer Safety and Transportation
- Jim Vena, Senior VP – Southern Region

1.1.7.2. Program Manager

Accountable and responsible for the end-to-end delivery of PTC, the Program manager will work to establish business requirements, roadmap, timelines, deliverables and budgets. He will also assess the need for outside help and oversee contract negotiations. As the link between the Steering Committee and the Leadership Team, he will also provide guidance and approve deliverables.

1.1.7.3. Project Manager

Using a Project Management Institute (PMI) inspired methodology; the Project manager will oversee the assessment and planning phase for the submission of the PTCIP, execution of the plan, testing and implementation of all of the PTC components. He will work closely with the Program Manager to define and manage scope, high level schedule and resource plan. He is responsible for tracking of deliverables and budgets, for coordinating all project activities and for providing relevant status information to the team.

1.1.7.4. Senior Managers (by areas)

The PTC system has been divided into 4 technical areas: the back office application, the communication network, the wayside systems and the locomotive on-board systems. Senior managers have been assigned to each component and are responsible for the gathering of data, design, sourcing, delivery and quality control of their respective area. In order to do so, they have access to internal resources and strategic partners with required skill sets. In addition, CN's Supply Management department will support the acquisition processes (RFI, RFP, RFQ) and contract negotiation during the PTC project.

1.1.7.5. Strategic Partners

CN has elected to work with strategic partners with proven track records in the railway and safety industry. Their deliverables are part of the overall plan and specifically aligned with their expertise and experience.

Wabtec Railway Electronics (21200 Dorsey Mill Road, Germantown MD 20876**)**: WRE has been selected to provide the Vital Electronic Train Management System to satisfy the statutory functionality as defined in the RSIA. As such, they will provide the content of the PTCDP in compliance with §236.1013.

Rail Safety Consulting (1151 Pittsford-Victor Rd. Pittsford, NY 14534): RSC is a consulting organization with detailed knowledge of safety designs and operating rules, processor-based systems and has worked with several railroads on their PTC plan. They have been contracted by CN to validate technical assumptions related to the system risk assessment and assist with the writing of the PTCIP. The mandate could be extended as project requires

Wayside Equipment Vendors: CN plans to evaluate and test WIU equipment from a number of equipment vendors to determine which equipment is best suited for use in each of the various wayside PTC applications (electronic control equipment, relay based interlockings, dark territory switches, etc). Equipment selected for use will be expected to meet accepted industry standards for vital wayside signaling equipment and CN will work closely with equipment manufacturers to ensure appropriate documentation is available to support the required PTCSP submission. CN will work closely with selected wayside equipment vendors to ensure that all equipment used for wayside PTC applications is installed and maintained in accordance with manufacturers recommendations.

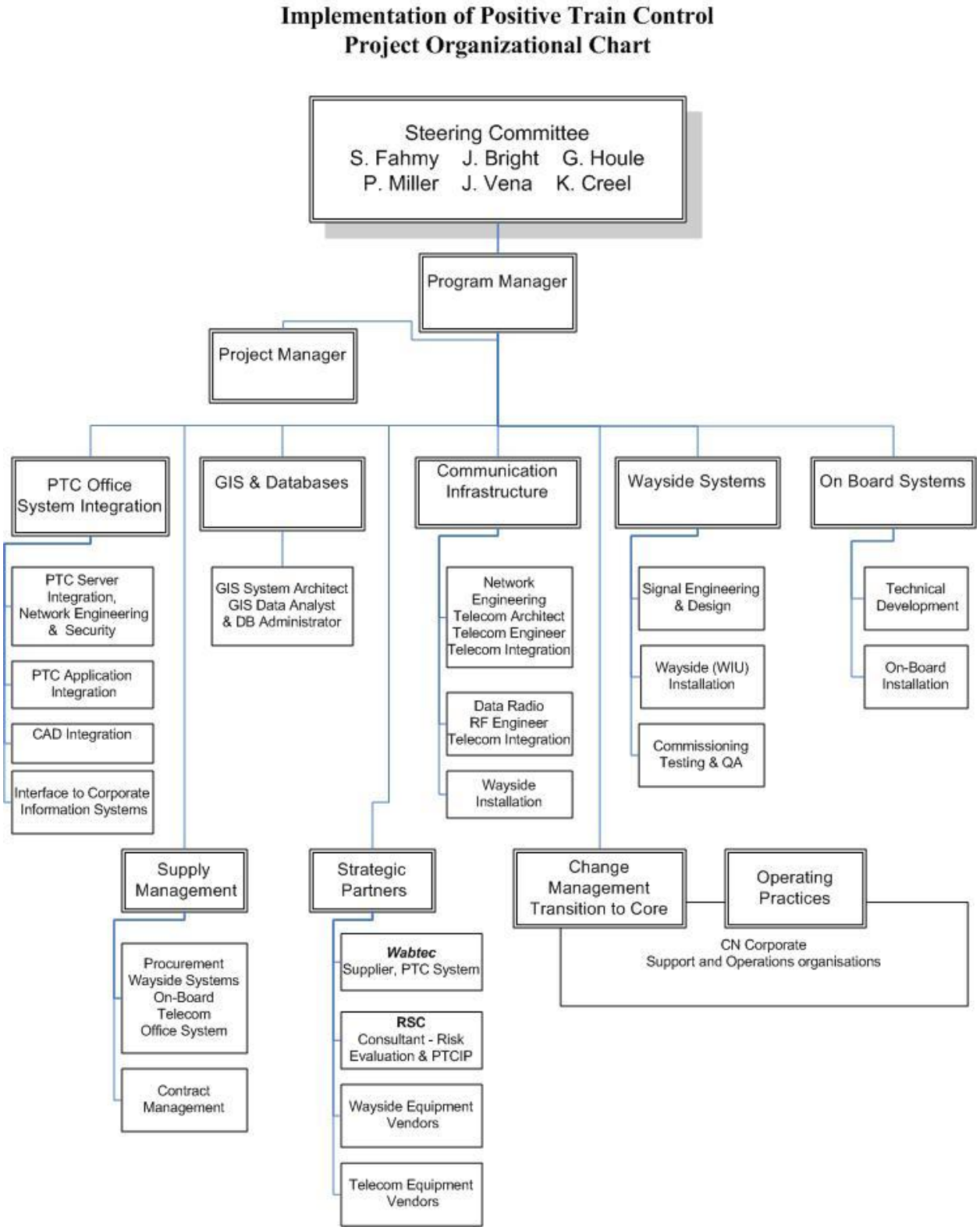
1.1.7.6. Other technical resources

During each phase of the project, technical resources will be made available as required to provide expertise and collaborate regarding various deliverables.

1.1.7.7. Change Management, Transition to Core & Operational Organizations

Once delivered, the PTC system and its components will be integrated into the Operations and Maintenance Manual as per §236.1039. To properly plan, manage and provide training to each area and personnel of the organization, a Change Management team will work on transition to core activities to engage the right department at the right time and provide the right level of information and training, as described in § 236.1041-49.

Figure 3 Organization Chart



1.1.8. Request for Amendment of a PTCIP [§ 236.1009(a)(2)(ii)]

This subsection describes how CN will make and file a Request For Amendment (RFA) of its PTCIP in accordance with § 236.1021 if an RFA is determined necessary.

On an annual basis, CN will review operations for any routing changes, such as traffic density changes above or below the 5 Million Gross Tons threshold or the presence or absence of both TIH/PIH hazardous materials or passenger trains and other changes listed in § 236.1005(b). The intent of this review will be to identify any changes made, or planned, to the system that requires an RFA to the PTCIP. If it is determined that any of the changes identified by the review, "Add, subtract, or otherwise materially modify one or more lines of railroad for which installation of a PTC system is required", CN will prepare a Request for Amendment of this PTCIP as per § 236.1021.

Prior to CN submitting the RFA or changing or altering traffic patterns, they will be reviewed by the CN PTC Steering Committee. The purpose of this internal review is to ensure that all requisite factors and data have been included in the internal evaluation and to update CN Senior Executives regarding the revised PTC deployment and funding requirements. The internal review will be scheduled as soon as practical but shall be completed in sufficient time to allow the RFA to be submitted to the FRA in conjunction with the annual PTCIP update required by April 16 each year.

Throughout the implementation of the CN PTC system, configuration management will be performed in accordance with the CN Configuration Management Plan (CMP). The CMP establishes the configuration management practices that will implement and maintain an effective and timely method for defining and controlling the configuration of all equipment. This includes design, manufacturing and installation of the fixed facilities, carborne and wayside equipment, and all interfaces. A software configuration management standard will be employed to properly track and control revisions to software against an established baseline software version. In addition, at the project level, operating procedures will be in place to provide for the proper updating, verification, control and installation of software throughout the project life-cycle, through and including field testing and in-service commissioning.

The configuration management of all FRA safety submittal documents (PTCIP, PTCDP, and PTCSP) is covered by this CMP. CN will review and approve the PTC vendor(s) Configuration Management Plan to ensure that it is consistent with the CN CMP.

In accordance with 49 C.F.R. § 236.1039, hardware, software, and firmware revisions will be documented in the Operations and Maintenance Manual per the practices established in the CN CMP.

1.2. Goals and Objectives

This section describes the overall goals and objectives of CN's PTC implementation initiative including specific objectives in the areas of quality, safety, network coverage, risk based deployment, interoperability and regulatory compliance.

The primary goal for the deployment of PTC technologies on CN's US network is to enhance system safety, with particular focus on the prevention of:

- train-to-train collisions
- overspeed derailments,
- incursions into established work zone limits
- the movement of trains through improperly-positioned switches

Enhancements to system safety will be achieved as a PTC vital overlay system is progressively deployed across all portions of the CN US network for which PTC deployment is required by 49 C.F.R. § 236.1005(b), with all required portions of the CN US network to be fully equipped, operational, and interoperable with all tenant railroads by December 31, 2015.

Goals and objectives relating to various aspects of PTC deployment are described in additional detail below.

1.2.1. Quality and Safety

Deployment of PTC technologies will be conducted in full compliance with all applicable Federal requirements, including those specified in 49 C.F.R. Part 236 Subpart I, and an acceptable level of safety will be maintained in the development, functionality, architecture, installation, implementation, inspection, testing, operation, maintenance, repair, and modification of the PTC technologies to be deployed. To ensure that an acceptable level of safety is achieved, the methodologies and activities to be defined in the PTCSP, as required by 49 C.F.R. § 236.1015, will be followed, and as a part of this, CN will ensure that all vendors from whom PTC technologies are to be acquired will have an acceptable quality assurance program for both design and manufacturing processes. The "systems" approach that will be employed by CN will also help ensure safe and reliable functionality and interaction between the wayside, on-board, and office components of the PTC system, with the communications component of the system playing a crucial role in accommodating this safe and reliable interaction. This holistic view will be necessary, as it is anticipated that products from multiple vendors will be integrated into the PTC system design.

1.2.2. System Coverage

In complying with the requirements of § 236.1005, CN will be installing PTC technologies on 41 of its 82 US subdivisions, corresponding to approximately 62% of CN's 6,213 total US network route miles. Of the roughly 3,720 route miles to be equipped, approximately 1,180 route miles accommodated passenger operations in 2008. A total of (redacted material) cars of TIH/PIH were handled on the 3,720 route miles that will be equipped with PTC, which represents 97% of the total of (redacted material) cars of TIH/PIH handled on the CN US track network. Implementing PTC on subdivisions where passenger traffic and/or a substantial amount of TIH/PIH traffic is present will reduce the risk associated with catastrophic accidents involving passenger trains and TIH/PIH materials, in keeping with Congress's mandate, as outlined in RSIA08.

1.2.3. Progressive Risk-Based Deployment

The progressive deployment of PTC technologies across CN's subdivisions will take place in a manner such that, to the extent practical, the PTC system will be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk. Deployment of PTC on the CN network will focus on a corridor oriented approach where higher risk corridors between major terminals are equipped in priority order. CN will also achieve progressive implementation of onboard systems and deployment of PTC-equipped locomotives such that the safety benefits of PTC are achieved through incremental growth in the percentage of equipped controlling locomotives operating on PTC lines.

1.2.4. Interoperability

The PTC system will provide for interoperability between CN and all tenant railroads, as technical, semantic, and organizational interoperability will be achieved to enhance the ability of CN and its tenants to operate together safely. Interoperability between CN and its tenants will be achieved through product testing, industry partnership, common technology, and standard implementation. CN and its tenants will work closely together throughout the PTC deployment process to ensure that all aspects of interoperability are fully addressed, and this partnership will be on-going as the railroads proceed to operate on these equipped portions of the CN network into the foreseeable future.

1.2.5. Regulatory Compliance

In order to meet the December 31, 2015 deadline mandated by Congress, CN has developed this PTCIP in accordance with § 236.1011 and provides the accompanying PTCDP in accordance with § 236.1013, both of which are being submitted to FRA for approval by the required April 16, 2010 deadline. It is CN's intent to achieve FRA PTC System Certification by April 30, 2012 and to deploy PTC on all required portions of the network by August 15, 2015, such that CN's PTC system will be fully operational by December 31, 2015.

1.3. Success Criteria

This section of the PTCIP describes the metrics that will be applied to gauge the success of long term and intermediate implementation goals. For clarification, when referred to in this section, long term goals shall refer to CN's implementation milestones from a system point of view. Intermediate goals shall refer to CN's implementation milestones from a subdivision point of view.

1.3.1. Long Term Goal Metrics

To gauge long term goals, CN shall use the following metrics for System PTC Implementation and Locomotive Installation. The remaining metrics will be on a subdivision to subdivision basis and are described in *Section 1.3.2 Intermediate Goal Metrics*.

1.3.1.1. PTC System Implementation

A subdivision will be considered complete when PTC System Certification is received by CN as set forth in § 236.1015(a). CN sets forth the following yearly metrics for the number of subdivision it shall have running PTC:

- 2011: 2 of 41 subdivisions have been completed, and 2 subdivisions will be partially completed, 10% of track.
- 2012: 12 of 41 subdivisions have been completed, 32% of track.
- 2013: 22 of 41 subdivisions have been completed, 57% of track.
- 2014: 34 of 41 subdivisions have been completed, 81% of track.
- 2015: 41 of 41 subdivisions have been completed, 100% of track.

1.3.1.2. Locomotive Installation

Since CN does not assign its locomotives per subdivision, it is appropriate to consider the equipping of rolling stock as a long term goal. CN sets forth the following yearly metrics for the number of locomotives that it shall have equipped with PTC:

- 2010: 12 of 1000 locomotives have been equipped 1%
- 2011: 187 of 1000 locomotives have been equipped 19%
- 2012: 397 of 1000 locomotives have been equipped 40%
- 2013 613 of 1000 locomotives have been equipped 61%
- 2014: 804 of 1000 locomotives have been equipped 80%
- 2015: 1000 of 1000 locomotives have been equipped 100%

1.3.2. Intermediate Goal Metrics

Intermediate goals shall refer to those milestones that can best be used on a subdivision to subdivision basis. When all of these intermediate goals have been completed, a subdivision shall be considered cutover to PTC operations.

1.3.2.1. Infrastructure Installation Completed

Infrastructure installation for a subdivision shall be completed when the following have been installed and tested for functionality:

- 100% of the communication system
- 100% of the track infrastructure
- 100% of the waysides

1.3.2.2. GIS Validated

There are two intermediate goals on each subdivision that are a result of Geographic Information System (GIS) data. GIS data shall be considered validated for a subdivision when the following are completed:

- Track Survey Completed
- Track Database Validated & Verified

1.3.2.3. Field Testing Completed

The completed field testing shall conform with § 236.1015(d)(10). This testing will be made up of the following:

- Host Railroad PTC Operation Tested
- Interoperable PTC Functionality Tested

1.3.2.4. Training Completed

As an intermediate goal, training shall be considered completed once the following have been accomplished:

- A sufficient number of dispatchers will have been trained to operate each subdivision that has been cut over to PTC.
- A sufficient number of engineers will have been trained to operate all locomotives that are functioning under the PTC umbrella.
- A sufficient number of field maintainers and supervisors will have been trained to service all PTC-equipped track that has been put into service as such.

1.3.2.5. PTCSP Submitted

As put forth in § 236.1015, the host railroad is required to submit a PTCSP in order to get its subsequent PTC System Certificate. This intermediate goal shall be considered complete once the PTCSP has been submitted to the FRA.

1.3.2.6. PTC System Certification Received

§ 236.1015(a) states that the "receipt of a PTC System Certification affirms that the PTC system has been reviewed and approved by the FRA in accordance with, and meets the requirements of, this part." Once CN receives the PTC System Certification, the subdivision shall be considered operational.

1.4. Applicability

RSIA requires that all carriers providing intercity or commuter rail passenger transportation or mainline freight lines carrying at least 5 million gross tons of freight annually and carrying any amount of TIH materials within the US have a system of Positive Train Control in operation by December 31, 2015. The law also goes on to require that railroads that meet the above criteria shall submit to the Secretary of Transportation a plan for the implementation of said systems by the date required, April 16, 2010.

CN, as a carrier which meets these criteria on some of its track, will deploy PTC on those sections where it is required and provides this implementation plan in fulfillment of the statute.

Section 6 of this document contains detail by subdivision of the pertinent information required to assess the requirement for PTC deployment. Section 13 contains information on all sections of track where we are applying for an MTEA and section 14 contains information in regards to De-Minimis exclusions that will not be PTC equipped.

1.5. Document Overview

This section provides an overview of the organization of the PTCIP, which CN is submitting as required by 49 U.S.C. § 20157 and § 236.1005 prior to implementing the PTC system.

- Section 1 describes the general objectives, applicability, and scope of the document.
- Section 2 lists all applicable documents that are referenced in this PTCIP.
- Section 3 describes the functional requirements that the proposed system must meet as required by § 236.1011(a)(1).
- Section 4 describes how the CN intends to comply with § 236.1009I as required by § 236.1011(a)(2).
- Section 5 defines how the CN will provide for interoperability between the host and all tenant railroads as required by § 236.1011(a)(3).

- Section 6 identifies which track segments the railroad designates as main line and non-main line track, as required by § 236.1011(a)(8).
- Section 7 describes how the PTC system will be implemented to address areas of greater risk to the public and CN employees before areas of lesser risk, by evaluating multiple risk factors, as required by § 236.1011(a)(4).
- Section 8 defines the sequence, schedule, and decision basis for the line segments to be equipped, including the risk factors by line segment, as required by § 236.1011(a)(5). Section 8 also identifies and describes the CN's basis for determining that the risk-based prioritization in Section 6 above is not practical as required by § 236.1011(a)(9).
- Section 9 identifies the rolling stock that will be equipped with the PTC technology, as required by § 236.1011(a)(6) and defines the schedule for implementation.
- Section 10 identifies the number of wayside devices required for each line segment and the schedule to complete the installations by December 31, 2015, as required by § 236.1011(a)(7).
- Section 11 contains the scheduled dates for PTCDP and PTCSP delivery as required by § 236.1011(a)(10).
- Section 12 contains the strategy for full system-wide deployment of PTC systems beyond those line segments required to be equipped under 49 C.F.R. Part 236, Subpart I, including the criteria that will be applied in identifying those additional lines as required by § 236.1011(b).
- Section 13 contains the Main Line Track Exclusion Addendum as defined by § 236.1019.
- Section 14 contains the De-Minimis exception requests as defined by § 236.1005 (b)(4)(ii).

1.6. Acronyms and Definitions

This section includes definitions of all terms, abbreviations, and acronyms required to properly interpret the Implementation Plan.

The following is a list of some abbreviations and acronyms that may be used in the PTCIP:

Table 1 Acronyms

Acronym	Meaning
AAR	Association of American Railroads
ABS	Automatic Block Signal
ATC	Automatic Train Control
ATS	Automatic Train Stop
BCP	Base Communication Packages
BNSF	Burlington Northern Santa Fe Railway
CAD	Computer Aided Dispatch
CDU	Computer Display Unit
C.F.R.	Code of Federal Regulations
CG	Central Gulf Railway
CMP	Configuration Management Plan
CN	Canadian National Railway
ConOps	Concept of Operations
CSSSB	Chicago South Shore and South Bend Railroad
CSXT	CSX Transportation
CTC	Centralized Traffic Control
C&J	C&J Railroad Company (Mississippi Delta Railroad)
EJ&E	Elgin, Joliet & Eastern Railway Company
ETMS	Electronic Train Management System
FRA	Federal Railroad Administration
GIS	Geographic Information System
GPS	Global Positioning System
GTM	Gross Ton Miles
HESR	Huron and Eastern Railway
HHP	High Horsepower
HMI	Human Machine Interface
IANR	Iowa Northern Railway
IHB	Indiana Harbour Belt Railway
ITC	Interoperable Train Control
LHP	Low Horsepower
MGT	Million Gross Tons
MSE	Mississippi Export
MTEA	Main Line Track Exclusion Addendum
NPI	Notice of Product Intent
NS	Norfolk Southern Railway Company
PIH	Poison by Inhalation Hazard
PMI	Project Management Institute
PTC	Positive Train Control
PTCDP	Positive Train Control Development Plan
PTCIP	Positive Train Control Implementation Plan

PTCSP	Positive Train Control Safety Plan
QUI	Quadrennial Inspections
RFA	Request For Amendment
RFI	Request for Information
RFP	Request for Proposal
RFQ	Request for Quotation
RSIA	Railway Safety Improvement Act
STB	Surface Transportation Board
TCS	Train Control System
TWC	Track Warrant Control
TIH	Toxic Inhalation Hazard
TMC	Train Management Computer
TSBY	Tuscola and Saginaw Bay Railway Company
UPRR	Union Pacific Railroad
U.S.C.	United States Code
V-ETMS	Vital Electronic Train Management System
WIU	Wayside Interface Unit
WRE	Wabtec Railway Electronics
WSOB	Wisconsin and Southern Railway

The following is a list of definitions of terms applicable to the PTCIP:

Table 2 Definition of Terms

Term	Definition
Class I railroad	A railroad which in the last year for which revenues were reported exceeded the threshold established under regulations of the Surface Transportation Board (49 C.F.R. part 1201.1-1 (2008)).
Fail-Safe	A design philosophy applied to safety-critical systems such that the results of hardware failures or the effect of software error shall either prohibit the system from assuming or maintaining an unsafe state or shall cause the system to assume a state known to be safe. (IEEE-1483)
Host railroad	A railroad that has effective operating control over a segment of track.
Interoperability	The ability of a controlling locomotive to communicate with and respond to the PTC railroad's positive train control system, including uninterrupted movements over property boundaries.
Main line	Except as excepted pursuant to § 236.1019 or where all trains are limited to restricted speed, a segment or route of railroad tracks, including controlled sidings: (1) of a Class I railroad, as documented in current timetables filed by the Class I railroad with the FRA under § 217.7, over which 5,000,000 or more gross tons of railroad traffic is transported annually; or (2) used for regularly scheduled intercity or commuter passenger service, as defined in 49 U.S.C. § 24102, or both.
Main line track exclusion addendum	The document defined by § 236.1019 requesting to designate track as other than main line.

NPI	Notice of Product Intent as further described in § 236.1013.
PTC	Positive Train Control to meet the requirements described in § 236.1005.
PTCDP	PTC Development Plan as further described in § 236.1013.
PTCIP	PTC Implementation Plan as required under 49 U.S.C. § 20157 and further described in § 236.1011.
PTC railroad	Each Class I railroad and each entity providing regularly scheduled intercity or commuter rail passenger transportation.
PTC System Certification	Certification as required under 49 U.S.C. § 20157 and further described in §§ 236.1009 and 236.1015.
PTCSP	PTC Safety Plan as further described in § 236.1015
Request For Amendment	A request for an amendment of a plan or system made by a PTC railroad in accordance with § 236.1021.
Restricted speed	A speed that allows stopping in half the range of vision, short of : train, engine, railroad car, men or equipment fouling the track, stop signal, derail or switch lined properly. When a train or engine is required to move at restricted speed, the crew must keep a look out for broken rail and not exceed 20 MPH.
Safety-critical	Safety-critical, as applied to a function, a system, or any portion thereof, means the correct performance of which is essential to safety of personnel or equipment, or both; or the incorrect performance of which could cause a hazardous condition, or allow a hazardous condition which was intended to be prevented by the function or system to exist. (236H) A term applied to a system or function, the correct performance of which is critical to safety of personnel and/or equipment; also a term applied to a system or function, the incorrect performance of which may result in an unacceptable risk of a hazard. (IEEE-1483)
Segment of track	Any part of the railroad where a train operates.
Tenant railroad	A railroad, other than a host railroad, operating on track upon which a PTC system is required.
Track segment	Segment of track
Vital Function	A function in a safety-critical system that is required to be implemented in a fail-safe manner. Note: Vital functions are a subset of safety-critical functions. (IEEE-1483)

2. Applicable Documents

This section provides a complete list of all the documents and other sources referenced in the PTC Implementation Plan.

1. 49 C.F.R. 236 Subpart I, "Positive Train Control Systems; Final Rule", Docket No. FRA-2008-0132, 15 January 2010
2. 49 C.F.R. Part 236 Subpart H
3. FRA's PTC Implementation Plan Template
4. FRA's Risk Prioritization Model for PTC System Implementation Template
5. Vital Electronic Train Management System (V-ETMS) - Positive Train Control Development Plan (PTCDP), 24 March 2010 Version 1.0
6. 49 C.F.R. 234.211, "Grade Crossing Signal System Safety", Subpart D, "Maintenance, Inspection, and Testing Maintenance Standards", "Security of Warning System Apparatus" – 5 December 2005
7. 49 C.F.R. 229.135, "Railroad Locomotive Safety Standards", "Event Recorders" – 15 January 2010
8. MIL-STD-882C, "System Safety Program Requirements" with Notice, 1 DoD, 13 March 1996.

Note: For dated references, only the edition cited applies. For undated references, the latest edition of the reference document applies, including amendments.

3. Functional Requirements [§ 236.1011(a)]

As required by 49 C.F.R. § 236.1011(a)(1) this section of the PTCIP provides a general description of the functional requirements that the proposed PTC system must meet as well as a brief overview of the proposed system technology and architecture.

3.1. V-ETMS Development Plan Overview

A full and comprehensive description of the V-ETMS functionality is provided in the "Vital Electronic Train Management System (V-ETMS) Positive Train Control Development Plan." The PTCDP describes how V-ETMS satisfies the mandated requirements for PTC systems as outlined in §236.1005. On 24 March 2010, the PTC Development Plan prepared by Wabtec Railway Electronics, CSX Transportation, Norfolk Southern Railway, and Union Pacific Railroad was submitted to the FRA for review and approval. The PTCDP was jointly submitted for FRA Type Approval as set forth under 49 C.F.R. Part §236.1009(b) and included documentation as required by §236.1013.

The Vital Electronic Train Management System Development Plan describes development of the WRE Vital Electronic Train Management System, an interoperable PTC system developed in compliance with requirements and standards defined through the ITC industry effort.

A summary of the key sections of the V-ETMS PTCDP document is provided below:

- PTCDP Section 3 provides a complete description of the V-ETMS system including a list of all product components and their physical relationships in the subsystem or system, as required by 49 C.F.R. § 236.1013(a)(1).
- PTCDP Section 4 describes how V-ETMS architecture satisfies safety requirements as required by 49 C.F.R. § 236.1013(a)(4).
- PTCDP Section 5 provides a description of how V-ETMS will enforce authorities and signal indications as required by 49 C.F.R. § 236.1013(a)(9) and how V-ETMS will enforce all integrated hazard detectors in accordance with § 236.1005(c)(3) as required by 49 C.F.R. § 236.1013 (a)(11).
- PTCDP Section 6 contains a description of the various railroad categories of operation for which V-ETMS is designed to be used as required by 49 C.F.R. § 236.1013(a)(2).
- PTCDP Section 7 contains an operational concepts document as required by 49 C.F.R. § 236.1013(a)(3).
- PTCDP Section 8 describes the target safety levels for V-ETMS including requirements for system availability as required by 49 C.F.R. § 236.1013(a)(8).
- PTCDP Section 9 provides a preliminary human factors analysis as required by 49 C.F.R. § 236.1013(a)(5).

- PTCDP Section 10 describes a prioritized service restoration and mitigation plan and a description of the necessary security measures for V-ETMS as required by 49 C.F.R. § 236.1013(a)(7).

- PTCDP Section 11 contains an analysis of the applicability of the requirements of subparts A-G of 49 C.F.R. as required by 49 C.F.R. § 236.1013(a)(6).

- PTCDP Section 12 provides a description of the deviation which may be proposed under § 236.1029(c), if applicable, as required by 49 C.F.R. § 236.1013(a)(10).

3.2. V-ETMS Technical Description

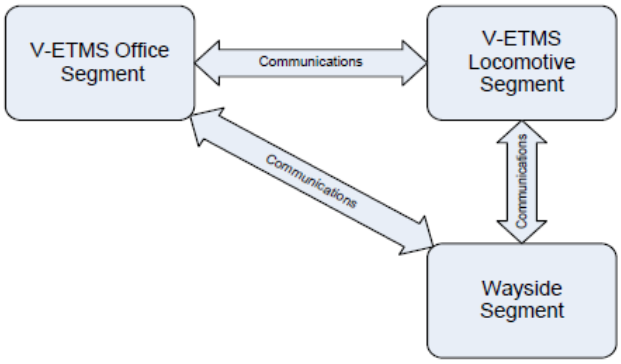
V-ETMS is a locomotive-centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety through enforcement of a train's authorized operating limits, including:

1. protection against train to train collisions,
2. derailments due to over-speed,
3. unauthorized incursion into established work zones, and
4. operation through main track switches in improper position.

The V-ETMS system is designed to support different railroads and their individual methods of operations and is intended to be capable of being implemented across a broad spectrum of railroads without modification. This design approach supports interoperability across railroads as V-ETMS equipped locomotives will apply consistent warning and enforcement rules regardless of track ownership.

The V-ETMS system consists of components physically and logically divided into four subsystems or segments: Locomotive, Office, Communications, and Wayside (see figure below).

Figure 4 V-ETMS System Components



Communications Segment: The *Communications Segment* provides connectivity between each of the other segments.

Locomotive Segment: The *Locomotive Segment* refers to a set of independent On-board hardware, software, and devices that interface with locomotive control equipment (e.g. air brakes, train line) and the Communication Segment aboard a locomotive. The Locomotive Segment employs a Train Management Computer (TMC). Software running on multiple processor modules is used to perform all train control functions such as determination of current position, calculation of warning and braking distances, management of limits or restrictions conveyed by verbal or electronic mandatory directive or signal indication, management of off-board communications, and communication with the Computer Display Unit (CDU).

Office Segment: The *Office Segment* refers to a collection of software functions that may be distributed across multiple hardware platforms. The Office Segment is responsible for delivering data provided by railroad back office systems to V-ETMS-equipped locomotives. Data provided by existing, external railroad office systems may include train activation, engine consist, summary and detailed train consists, movement authorities, temporary speed restrictions, work zones, cautionary orders, weather, and critical alert information.

Wayside Segment: The *Wayside Segment* consists of those signaling appliances located in the field whose status impacts V-ETMS operations, along with any wayside interface units (WIUs) used to monitor and report their status. WIU monitors the status of one or more attached wayside devices and includes an interface to the Communications Segment. The WIU acquires and publishes the status of attached wayside devices via the Communications Segment to the V-ETMS Locomotive and/or Office Segments.

3.3. V-ETMS Functional Description

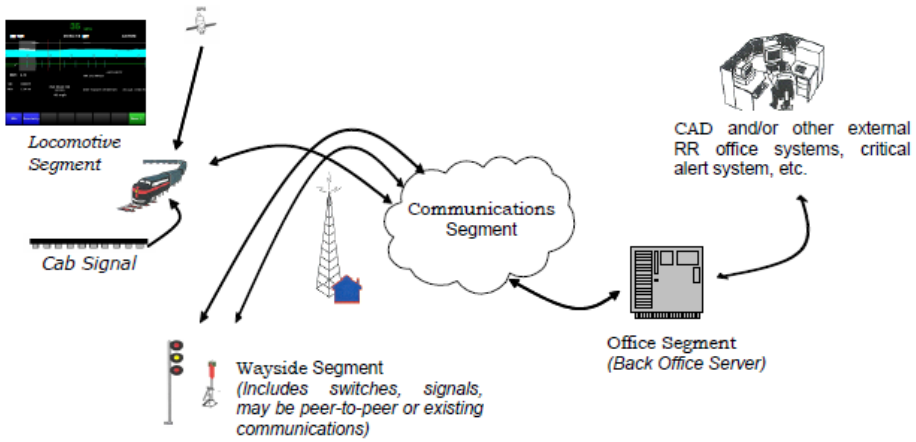
Descriptions of the V-ETMS system, its primary functions, the architecture of the PTC system(s) being deployed, and a high level description of the functionality of the PTC system, subsystems, and interfaces are all found in the PTCDP. The following sections provide an overview of the key functional areas as identified in 49 C.F.R. 236 Subpart I.

3.3.1. V-ETMS Components

Section 3 of the V-ETMS PTCDP provides a complete description of the V-ETMS system including a list of all product components and their physical relationships in the subsystem or system, as required by 49 C.F.R. § 236.1013(a)(1). Please reference the following subsections within Section 3 of the PTCDP:

3.1 Locomotive Segment
3.2 Office Segment
3.3 Wayside Segment
3.4 Communications Segment
3.5 Data Flow
3.6 V-ETMS Primary Functions

Figure 5 V-ETMS System Data Flow



3.3.2. V-ETMS Architecture

Section 4 of the V-ETMS PTCDP describes how the V-ETMS architecture satisfies safety requirements as required by 49 C.F.R. § 236.1013(a)(4). Please reference the following subsections within Section 4 of the PTCDP:

4 PTC Architecture
4.1 Locomotive Segment
4.1.1 V-ETMS Train Management Computer
4.1.2 Computer Display Unit
4.1.3 GPS Receiver
4.1.4 Locomotive Event Recorder
4.1.5 Train Control Application
4.1.6 Business Applications
4.2 Office Segment
4.2.1 V-ETMS Office Segment
4.2.2 Office Server Platform
4.2.3 Office Segment External Interfaces
4.3 Wayside Segment
4.3.1 WIU Technology
4.4 Communications Segment
4.4.1 The Messaging System
4.4 Wireless Networks

3.3.3. V-ETMS Functional Requirements

The Concept of Operations contained in Appendix A of the PTCDP is provided as required by §236.1013(a)(3). The Concept of Operations addresses each of the PTC functional requirements and provides a thorough description of the system's ability to meet the requirements. For purpose of this PTCIP, each requirement is addressed by providing a cross reference to the pertinent section of Appendix A of the PTCDP, as follows:

1. § 236.1005 (a)(1)(i)– Reliably and functionally prevent train to train collisions including trains operating over rail to rail at grade crossings;

    - Section 5.4 Train Movement
    - Section 5.4.1 Movement Authority Provided by Mandatory Directive
    - Section 5.4.2 Wayside Signals
    - Section 5.4.3 Cab Signals
    - Section 5.4.4 Reverse Movement
    - Section 5.4.5 Switching Mode
    - Section 5.4.6 Entry to V-ETMS Territory
    - Section 5.4.7 Exit from V-ETMS Territory
    - Section 5.4.8 Yard Limits
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement
    - Section 5.11.3 Restrictive Speed Enforcement

Railroads must address rail-to-rail crossings at grade as part of the requirement that they address train-to-train collisions. In all cases where PTC equipped lines are involved, an interlocking signal arrangement developed in accordance with subparts A through G of part 236 will be in place. V-ETMS is designed to prevent train to train collisions where interlocking signals are in place as described in the V-ETMS PTCDP Sections 5.4.2 Wayside Signals and 5.4.3 Cab Signals. The method to be used by CN for protecting non-PTC routes at rail-to-rail crossing-at-grade will be dependent on the speed and the specific field conditions of each location, availability of alternate technologies to provide positive stop enforcement, and the presence of PTC equipped locomotives operating on the non-PTC routes.

2. § 236.1005 (a)(1)(ii) – Reliably and functionally prevent overspeed derailments, including derailments related to railroad civil engineering speed restrictions, slow orders, and excessive speeds over switches and through turnouts;
    - Section 5.4.8 Yard Limits
    - Section 5.5 Speed Limits and Restrictions
    - Section 5.5.1 Permanent Speed Restrictions
    - Section 5.5.2 Temporary Speed Restrictions
    - Section 5.5.3 Track Authority Speed Restrictions
    - Section 5.5.4 Consist or Lading Speed Restriction
    - Section 5.11 Warning and Enforcement
    - Section 5.11.1 Reactive (Over-speed) Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement
    - Section 5.11.3 Restricted Speed Enforcement

3. § 236.1005 (a)(1)(iii) – Reliably and functionally prevent incursions into established work zone limits without first receiving appropriate authority and verification from the dispatcher or roadway worker in charge, as applicable and in accordance with 49 C.F.R. part 214;
    - Section 5.6 Work Zones
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement

4. § 236.1005 (a)(1)(iv) – Reliably and functionally prevent the movement of a train through a main line switch in the improper position as further described in § 235.1005;
    - Section 5.10 Route Integrity Protection
    - Section 5.10.1 Monitored Hand-Operated Switches
    - Section 5.10.2 Switches in Signaled Territory
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement

5. § 236.1005 (a)(2) - Include safety-critical integration of all authorities and indications of a wayside or cab signal system, or other similar appliance, method, device, or system of equivalent safety, in a manner by which the PTC system shall provide associated warning and enforcement to the extent, and except as, described and justified in the FRA approved PTCDP or PTCSP, as applicable;
    - Section 5.4 Train Movement
    - Section 5.4.2 Wayside Signals
    - Section 5.4.3 Cab Signals
    - Section 5.10.2 Switches in Signalled Territory
    - Section 5.10.3 Other Monitored Devices
    - Section 5.11 Warning and Enforcement
    - Section 5.11.1 Reactive (Over-speed) Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement
    - Section 5.11.3 Restrictive Speed Enforcement

6. § 236.1005 (a)(3) – As applicable, perform the additional functions specified in the subpart;

7. § 236.1005 (a)(4)(i) - A derail or switch protecting access to the main line required by § 236.1007, or otherwise provided for in the applicable PTCSP, is not in its derailing or protecting position, respectively;
    - Section 5.4.2 Wayside Signals
    - Section 5.10.3 Other Monitored Devices
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement

8. § 236.1005 (a)(4)(ii) – Provide an appropriate warning or enforcement when a mandatory directive is issued associated with a highway-rail grade crossing warning system malfunction as required by § 234.105, § 234.106, or§ 234.107;
    - Section 5.7 Malfunctioning Highway Grade Crossing Warning Systems
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement

9. § 236.1005 (a)(4)(iii) – Provide an appropriate warning or enforcement when an after-arrival mandatory directive has been issued and the train or trains to be waited on has not yet passed the location of the receiving train;
    - Section 5.4.1.1 Track Warrant Control

10. § 236.1005 (a)(4)(iv) – Provide an appropriate warning or enforcement when any movable bridge within the route ahead is not in a position to allow permissive indication for a train movement pursuant to § 236.312;
    - Section 5.4.2 Wayside Signals
    - Section 5.10.3 Other Monitored Devices
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement

11. § 236.1005 (a)(4)(v) – Provide an appropriate warning or enforcement when a hazard detector integrated into the PTC system that is required by § 236.1005 (c) of this section, or otherwise provided for in the applicable PTCSP, detects an unsafe condition or transmits an alarm;
    - Section 5.4.2 Wayside Signals
    - Section 5.10.3 Other Monitored Devices
    - Section 5.11 Warning and Enforcement
    - Section 5.11.2 Predictive Warning and Enforcement

12. § 236.1005 (a)(5) – Limit the speed of passenger and freight trains to 59 miles per hour and 49 miles per hour, respectively, in areas without broken rail detection or equivalent safeguards;
    - Section 5.5.1 Permanent Speed Restrictions
    - Section 5.11 Warning and Enforcement
    - Section 5.11.1 Reactive (Over-speed) Warning and Enforcement

4. Compliance [§ 236.1011(A)(2)]

This section describes how CN will comply with § 236.1009(d), which requires the railroad to apply for and receive PTC System Certification from the FRA. It is understood that the PTC System Certification must be received before deploying a PTC system(s) in revenue service.

In addition, this section describes any identified or potential risks or other items that could create or suggest increased difficulty in the successful completion and delivery of the PTC system installation on or prior to the required date. It also identifies general contingency plans to deal with risks.

4.1. PTC System Certification

CN is pursuing the installation of a PTC system that is fully interoperable with the other Class 1 freight railroads and is actively engaged in the ITC (Interoperable Train Control) initiative. The PTC system that will be installed on CN track will be based on the same equipment technologies and system architecture as the other ITC affiliated railroads.

4.1.1. Utilization of Existing Type Approval and/or PTCDP

The PTC technology chosen by CN is the same system that has been chosen by most of the Class 1 railroads and is based on the Wabtec Vital Electronic Train Management System platform. It is CN's understanding that the PTCDP for the Wabtec V-ETMS has been submitted by a number of other Class 1 railways for review and approval by the FRA. At the time of submission of this PTCIP, the FRA has not granted a Type Approval number for the V-ETMS platform described in the PTCDP. Accordingly, CN is resubmitting that PTCDP that has been developed in accordance with § 236.1013 in compliance with the requirements of § 236.1009 (b)(2) with this PTCIP.

In the event that Type Approval is received for the Wabtec V-ETMS based PTC platform based on the Wabtec V-ETMS PTCDP submission the FRA has received from other railways, CN would like to utilize this Type Approval for its PTC system certification request.

CN will identify clearly and explain in its PTCSP any and all variances between the CN proposed PTC system implementation and the V-ETMS platform Type Approval or PTCDP.

4.1.2. Certifying the Validity of Type Approval

Section § 236.1013(c) in the final rule states, "each Type Approval shall be valid for a period of 5 years, subject to automatic and indefinite extension provided that at least one PTC System Certification using the subject PTC system has been issued within that period and not revoked." It is CN's intent to achieve PTC system certification within the 5 year window provided in the rule.

4.1.3. Handling of Unique Aspects of the PTCDP and Type Approval

At the time of submission of this PTCIP, CN does not foresee any variances in technology or application from the standard Wabtec V-ETMS based PTC systems used by the other Class 1 freight railroads. Based on the decision to utilize a standard implementation of the V-ETMS based PTC system, CN is not documenting or submitting any unique PTC system aspects as part of its PTCDP or as a variance to the Type Approval.

CN has participated in a detailed review of the V-ETMS PTC product with Wabtec technical resources to ensure that the system will provide the functionality required to be successfully deployed on the CN network. In addition to the detailed technical reviews, CN utilizes the TMDS CAD system that was also designed and developed by Wabtec. A single source supplier of both the CAD and PTC office computer systems will help ensure successful integration of the PTC system on the CN network.

Throughout the PTC development and implementation process, CN will keep the FRA fully advised of any issues or circumstances that may develop that would require CN to implement a variance to the standard V-ETMS based PTC platform. This is to ensure that CN maintains compliance with PTC safety certification as rollout of our PTC implementation progresses. If required, an RFA will be submitted in accordance with § 236.1021.

4.1.4. Deliverables

As part of our PTC System Certification process, CN will supply the following deliverables to the FRA:

1. PTC Implementation Plan (PTCIP)
2. PTC Development Plan (PTCDP) or Type Approval Number
3. Full description of any variances to the PTCDP or Type Approval
4. PTC Safety Plan (PTCSP)

As required by Section § 236.1015 of the final rule, CN will include the following as part of our PTCSP documentation:

a. Type approval reference or copy of approved PTCDP
b. Documentation of installed PTC system variances from system covered by Type Approval of approved PTCDP
c. Human factors analysis of the installed system
d. Hazard log of all safety related hazards
e. Description of safety assurance concepts
f. Risk assessment of the as-built system
g. Hazard mitigation analysis,
h. Description of safety assessment and verification and validation processes
i. Description of railway employee training plan

j. Procedures and test equipment for employees to operate and maintain system safety through all phases of its life cycle

k. Configuration and revision control measures

l. Test plans and reports for system configuration and post-implementation testing.

m. System operations and maintenance documentation, including warnings and labels; Maintenance and failure records and management.

n. Safety analysis of potential for incursion into established work zone

o. Enforcement of integrated hazard detectors.

p. Description of how system enforces authorities and signal indications

q. Other documents as required by regulation or deemed necessary to support certification of the CN PTC system (e.g., rerouting plan, security requirements).

4.2. Risk Assessment

Successful implementation of PTC on CN can be impacted by a number of different risk factors. These risks could create difficulty in completing PTC systems deployment by the 31 December, 2015 completion date set by the FRA or impact the ability of the system to provide all of the required functionality. To help ensure successful PTC deployment, CN has implemented a risk management process to identify, mitigate, and monitor risks that could create or suggest increased difficulty in the successful completion and delivery of the PTC system installation on or prior to the required date.

This risk management process:

- identifies risks to meeting the goals and objectives of CN's PTC deployment
- predicts the consequences associated with the identified risks;
- implements risk mitigation strategies;
- monitors risk status; and
- establishes contingency plans.

This following summary of risks provides a general description of the principal risks that CN believes could impact successful implementation of PTC and is not intended to be an all-inclusive list of every conceivable impediment that could be encountered. CN will maintain the risk management process through which additional risks may be identified and existing risks may be closed as PTC installation progresses.

The sections below provide a summary of identified risks to CN's completion and delivery of PTC installation on or prior to December 31, 2015.

4.2.1. Performance Risks

Performance Objective 1: Enhance system safety, with particular focus on the prevention of train-to-train collisions, over-speed derailments, incursions into established work zone limits, and movement of trains through improperly-positioned switches.

Table 3 Performance Risk 1

Risk Description	Predicted Consequences	Risk Mitigation
PTC system does not deliver expected system safety benefits: • Does not prevent train to train collisions • Does not prevent overspeed derailments • Does not prevent incursions into established work zone limits • Does not prevent movement of trains through improperly positioned switches • Creates additional safety hazards that reduce system safety • An acceptable level of safety is not maintained in the development, functionality, architecture, installation, implementation, inspection, testing, operation, maintenance, repair, and modification of the PTC technologies to be deployed.	• PTC system cannot be deployed without modification of system behaviour. • PTC system cannot be deployed without re-assessment of achieved safety levels. • Deployed PTC system cannot obtain FRA Certification • Schedule delay • PTC system does not achieve expected results for PTC preventable incidents	• Follow system development methodology that captures PTC system requirements and provides traceability of those requirements throughout the system life cycle. • Rigorous safety program at all levels of system development. Methodologies and activities as required by 49 C.F.R. §236.1015 will be followed in the PTCSP.

Performance Objective 2: CN will maintain acceptable levels of operation on subdivisions operating under PTC.

Table 4 Performance Risk 2

Risk Description	Predicted Consequences	Risk Mitigation
CN incurs unacceptable train delays resulting from PTC operation • PTC implementation and/or system design introduces inefficiencies ○ wireless communication-related delays ○ Inefficient train operation resulting from braking algorithm • Reduction in efficiency resulting from running unequipped trains through PTC equipped territory because (a) Locomotives operating with PTC equipment installed but with equipment outages (b) trains not PTC-equipped. • Reduction in efficiency of personnel ○ Ineffective human factors design for PTC equipment • Ineffective and/or insufficient training of personnel	• Railroad incurs unacceptable train delays as a result of PTC • PTC deployment is delayed until productivity issues are resolved • Railroad incurs significant revenue penalties caused by service performance issues • Customers select alternate shipping options for products, potentially including TIH shipments	• Reliability program initiated to monitor, report, and improve reliability of equipment. • Identify and reach agreement with additional potential tenants for equipping with PTC equipment. • Monitor effectiveness of training – quality improvement program in place. • System development effort focusing on high technical risk areas to identify and mitigate potential system design and implementation-related contributions to decreased productivity

Contingency Plan: Existing method of operation can be maintained during/after PTC installation until acceptable safety and operational levels have been achieved and FRA Certification has been granted.

4.2.2. Deployment Risks

Deployment Objective 1: Enhancements to system safety will be achieved as a PTC vital overlay system is progressively deployed across all portions of the CN network for which PTC deployment is required by 49 C.F.R. § 236.1005(b).

Table 5 Deployment Risk 1

Risk Description	Predicted Consequences	Risk Mitigation
PTC system progressive installation is delayed because of • PTC equipment availability • Availability of trained installers • Ineffective coordination of installation plans result in interference between installation crews where infrastructure is complex and/or working space is limited. • Installation procedures become protracted • Acts of nature	• PTC system will not be installed across all portions of the CN network for which PTC deployment is required by 49 C.F.R. § 236.1005(b) • Full benefit of safety enhancements will not be realized by required date • CN may incur Civil Penalties	• Develop detailed plans for equipping rolling stock, wayside, and office with required PTC equipment. • Develop detailed training and personnel plans. • Work closely with vendors and other railroads in close geographic proximity to minimize risk associated with installation procedures and schedule. • Establish schedule performance metrics to measure PTC deployment progress. Monitor metrics to identify any potential schedule delays. Take action to avert potential schedule delays. • Deployment targeted to complete highest priority line segments first.

Deployment Objective 2: All required portions of the network to be fully equipped, operational, and interoperable with all tenant railroads by December 31, 2015.

Table 6 Deployment Risk 2

Risk Description	Predicted Consequences	Risk Mitigation
All required portions of the network are not fully equipped, operational, and interoperable with all tenant roads by December 31, 2015. • Unable to maintain equipage schedule • Delay in initiating PTC operations • Difficulty and/or delay in establishing required interoperability agreements with tenant railroads. • Difficulty and/or delay in achieving required levels of technical interoperability	• PTC system will not be installed across all portions of the CN network for which PTC deployment is required by 49 C.F.R. § 236.1005(b) • Full benefit of safety enhancements will not be realized by required date • CN may incur Civil Penalties	• See Risk Mitigation Strategy for Coverage risk #1 above. • Establish clear understanding of technical requirements and schedule for interoperability with each tenant road. • Establish performance metrics to measure tenant progress toward equipping rolling stock with interoperable PTC equipment.

Contingency Plan: Existing method of operation can be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted

4.2.3. Compliance Risks

Compliance Objective 1: PTC deployment will meet the PTC System Certification performance requirements in C.F.R. §236.1015

Table 7 Compliance Risk 1

Risk Description	Predicted Consequences	Risk Mitigation
The PTC system development does not fully satisfy all of the safety and quality assurance requirements documented in 49 C.F.R. §236. • The methodologies and activities as required by 49 C.F.R. §236.1015 are not applied consistently for the PTCSP. • Gaps in the V&V process are uncovered that impact the validity of testing results; or, at worst, the design of the system.	• PTC may not function as required to meet performance requirements. • PTC system may not enhance safety levels. • PTC system cannot be deployed without modification of system behaviour. • PTC system cannot be deployed without re-assessment of achieved safety levels. • Deployed PTC system cannot obtain FRA Certification • Schedule delay	• The methodologies and activities as required by 49 C.F.R. §236.1015 will be followed for the PTCSP. • CN will ensure that all vendors from whom PTC technologies are to be acquired will have an acceptable quality assurance program for both design and manufacturing processes. • Testing and documentation process audits are conducted periodically with vendors

Contingency Plan: Existing method of operation can be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted

4.2.4. Technical Risks

Technical Objective 1: PTC system as deployed successfully provides the required interoperability between CN and its tenants.

Table 8 Technical Risk 1

Risk Description	Predicted Consequences	Risk Mitigation
Interoperability between CN and its tenants is not achieved. • Unsuccessful in deploying interoperable radio and messaging technology • Semantic incompatibility between railroads	• PTC system will not be installed across all portions of the CN network for which PTC deployment is required by 49 C.F.R. § 236.1005(b) • Full benefit of safety enhancements will not be realized by required date • CN may incur Civil Penalties • Operational penalties incurred on key service corridors due trains operating with failed PTC equipment.	• Establish organizational structure to facilitate communication and coordination between host and tenant roads • CN participates in industry organizations to establish PTS system standards to achieve interoperability by working collaboratively on requirements definition, system/component design, and product testing to deploy interoperable, common technology.

Risk Description	Predicted Consequences	Risk Mitigation
		• Testing will ensure that implementations conform to industry standards. • Interoperability testing will be conducted.

Contingency Plan: Existing method of operation can be maintained during/after PTC installation until acceptable safety levels have been achieved and FRA Certification has been granted

5. Interoperability [§ 236.1011(a)(3)]

This section provides a description of how CN's PTC system will provide for interoperability as defined by 49 C.F.R. Part 236 Subpart I between CN and the following railroads with which CN has a host or tenant relationship excluding Class II and III railroads which as defined in 236.1006(b)(4) are permitted to operate on PTC-operated track with non-PTC equipped locomotives:

- Amtrak
- Burlington Northern Santa Fe
- CSX Transportation Inc.
- Canadian Pacific
- Kansas City Southern
- Metra
- Norfolk Southern Railway Company
- Union Pacific Railroad

5.1. Railroad Agreement Provisions Relevant to Interoperability [§ 236.1011(a)(3)(i)]

An ITC collaboration agreement was executed by and amongst several railroads wishing to achieve Positive Train Control system interoperability through, in part, the development of an interoperable train control system which would enable locomotives of one participant to transition at track speed to the control of another participant. The collaboration agreement includes a list of interoperability requirements mutually agreed-upon by the parties:

- Definition and adoption of uniform interface standards;
- Definition, adoption and implementation of AAR-standard communications protocols;
- Definition, adoption, and implementation of common office-locomotive communications protocols and message formats;
- Definition, adoption, and implementation of a common Human Machine Interface, allowing an engineer from any of the participant's roads to utilize the system on any participant's locomotives on territory for which the engineer is qualified;
- Adoption of a coordinated plan for configuration management of the interoperable PTC onboard executable software;
- Agreement on use of radio spectrum in the 220MHz band for communications between the locomotive and wayside and the locomotive and back office;
- Agreement to acquire, develop and deploy all of the technical capabilities required to permit the use of shared communications infrastructure; and

- Definition and adoption of standards allowing each participant's locomotive engineer, at the start of a trip, to initialize the interoperable onboard system with the back offices of participants' PTC systems which may be traversed during the trip to support all interoperability scenarios which will be encountered on the line-of-road with respective locomotive fleets and run-through operations.

The ITC collaboration agreement chartered the formation of various technical working committees, each dedicated to some technical aspect of PTC interoperability. Participation in the technical working committees was expanded beyond the chartering roads to include any railroad planning to implement an interoperable PTC system and wishing to participate.

CN is an active participant on many of the ITC technical teams although not formally party to the ITC collaboration agreement at this time. Through technical team activities, and also through engagements with the principal suppliers of PTC equipment that are party to the ITC development effort, CN is aware of the developments taking place, is confident that there is no impediment to adopting the standards and technology arising from this effort in our organization, and will be able to achieve interoperability.

CN has exchanged Letters of Understanding with each of its passenger tenant carriers (Metra and Amtrak) who are required to install and operate PTC as well as all other Class 1 Railways. The Letters of Understanding establish agreement between CN and these parties in the following areas:

- Implementation of PTC technical solutions which meet the requirements of interoperability as defined in § 236.1003(b);
- Participation in a PTC testing program to verify functionality and interoperability; and
- Exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

Copies of the memorandum of understanding letters are attached in Appendix D.

5.2. Types of Interoperability

CN will achieve interoperable PTC operations on with its tenant and host railroads which operate PTC systems in one of three technical methods.

5.2.1. Native Interoperability

CN and its interoperability partner both install and operate the V-ETMS on their respective locomotives, office, and wayside. V-ETMS provides for full functionality for any equipped locomotive, regardless of ownership, with any office or wayside correspondingly equipped. Interoperability is achieved through native operation of V-ETMS without the need for data, function, or human-machine interface (HMI) translation. Interoperable communications are achieved through adoption of the common communications and message protocols, and application behaviour specifications described in ITC interoperability requirements. V-ETMS encompasses the methods of operation and rules of both CN and its interoperability partner and accommodates any differences in the data provided by back office systems. V-ETMS and its operations are fully described in the Vital Electronic Management System

Positive Train Control Development Plan. Railroads with which CN will conduct interoperable PTC operations in this manner are as follows:

- Amtrak
- Burlington Northern Santa Fe
- CSX Transportation Inc.
- Canadian Pacific
- Kansas City Southern
- Metra
- Norfolk Southern
- Union Pacific Railroad

5.2.2. Onboard Functional Interoperability

CN and its interoperability partner install and operate different systems on their respective locomotives, office, and wayside. However, the locomotive onboard system of each is able to interoperate with the office and wayside infrastructure deployed on the other's property. Currently, CN does not have any interoperability partners that operate in this fashion.

5.2.3. Unequipped Operation

Some of CN interchange partners may operate their unequipped locomotives on CN PTC lines where FRA regulations allow. Although no technical form of interoperability is required or exists, such operations will be conducted as prescribed in § 236.1029 and will require procedural coordination amongst CN and its interchange partner. Railroads with which CN will interchange and allow unequipped operation on its PTC lines are as follows:

(Redacted Material)

5.3. Technology Applicable to Interoperability [§ 236.1011(a)(3)(ii)]

CN and its interoperability partners utilize methods in three areas to obtain and maintain interoperability of its PTC system(s):

5.3.1. Technical interoperability

Technical interoperability is achieved through the common use of documented interface definitions. These definitions include one or more radio protocols (220MHz) and hardware interfaces to radio equipment, a common standard messaging protocol (ITC Messaging), and standard data element and application message format and content definitions (V-ETMS interface control documents). Use of and compliance with these common interface definitions ensures the ability to exchange data messages between interoperable system components.

5.3.2. Semantic Interoperability

Semantic interoperability is achieved through the common use of documented system behavioural specifications. In the current ITC architecture, standard application-level specifications define the behaviour of the interoperable office, locomotive, and wayside segments. Use of and compliance with these common behavioural specifications ensures each interoperable system segment properly interprets and acts upon exchanged data messages.

5.3.3. Organizational interoperability

Organizational interoperability is achieved primarily through industry-wide forums, such as committees chartered by ITC and AAR. Technical teams operating under both the ITC and AAR charters are tasked with developing and maintaining the common technical standards in the areas of technical and semantic interoperability described above. These teams have worked to establish a baseline level of interoperability required for industry-wide PTC implementation. The teams will work in perpetuity to provide configuration management and ensure that interoperability is maintained as the interoperable PTC system(s) are enhanced. ITC and AAR teams also work to establish organizational interoperability in the areas of interchange and infrastructure sharing. Finally, CN has designated a liaison to ensure organization communications on PTC interoperability matters with each of its tenant railroads.

5.4. Obstacles to Interoperability [§ 236.1011(a)(3)(iii)]

As a hosting railroad, CN foresees no obstacles to achieving full interoperability with any and all tenant railroads that operate lead locomotives equipped for PTC certified as conforming to the specifications being established by the ITC consortium, and that also exchange the requisite information for operating a train as established by the ITC consortium.

As a tenant railroad, CN also foresees no obstacles to achieving full interoperability with any and all hosting railroads that operate a wayside equipped for PTC certified as conforming to

the specifications being established by the ITC consortium, and that also exchange the requisite information for operating a train as established by the ITC consortium.

CN intends to subject its PTC back office, wayside infrastructure and locomotive equipment for certification or install equipment already type-certified for interoperability as appropriate.

For Class 2 and Class 3 tenant railroads that are not required to install PTC (per 49 C.F.R. Part 236), operation of PTC un-equipped trains shall only be permitted in compliance with § 236.1006 (b)(4). In these cases, CN intends to mitigate risk by taking one of the following actions:

- Dispatch the train through CN track as a PTC-unequipped train, conforming to all the restrictions prescribed by § 236.1029.
- Enforce a requirement that the train have a functional PTC-equipped locomotive in the lead while operating on CN PTC-controlled track.
- Deny the unequipped train access to CN PTC-controlled track.

All tenant railroads that are required to install PTC (per 49 C.F.R. Part 236), will be expected to have a functional PTC-equipped locomotive in the lead while their train is operating on CN PTC-controlled track. In cases where a tenant railroad that is required to install PTC wishes to operate a train on CN PTC-controlled track and the train has a non-functional PTC-equipped locomotive, CN intends to mitigate risk by taking one of the following actions:

- Dispatch the train through CN track on an exception basis as a PTC-unequipped train, conforming to all the restrictions prescribed by § 236.1029.
- Realigning or re-consisting the motive power so that the train has a PTC-equipped locomotive in the lead, including supplying, if necessary, a CN PTC-equipped lead locomotive.
- Denying access to PTC-controlled track.

In cases where a tenant railroad that is required to install PTC wishes to operate a train on CN PTC-controlled track and the train does not have a PTC-equipped locomotive, CN intends to mitigate risk by taking one of the following actions:

- Until 31 December 2015, dispatch the train through CN track on an exception basis as a PTC-unequipped train, conforming to all the restrictions prescribed by § 236.1029.
- Realigning or re-consisting the motive power so that the train has a PTC-equipped locomotive in the lead, including supplying, if necessary, a CN PTC-equipped lead locomotive.
- Denying access to PTC-controlled track.

6. Designating Track as Main Line or Non-Main Line [§236.1011(a)(8)]

This section details which track segments CN considers main line and non-main line track as well as those track segments for which CN is requesting Mainline Track Exclusion Addendums as defined § 236.1019.

6.1. CN Network Descriptions

The following sections provide descriptive information on some of the unique aspects of the CN Network as it applies to this PTC Implementation Plan.

6.1.1. EJ&E Acquisition

On February 1st, 2009, CN completed its acquisition of the principal lines of the EJ&E. The closing follows the Jan. 23, 2009, effective date of the Surface Transportation Board's (STB) Dec. 24, 2008, decision approving the transaction. Since completing the transaction, CN has followed a measured, step-by-step integration of the acquired EJ&E lines to ensure a safe, efficient combination of the two rail operations. The EJ&E runs in an arc around the City of Chicago from Waukegan, Ill., on the north, to Joliet, Ill., on the west, to Gary, Ind., on the southeast, and then to South Chicago.

As part of the PTC planning process, CN has included the acquired EJ&E assets and has applied the same PTC evaluation process to the acquired assets that has been implemented on all other CN tracks. Due to the date of the transaction, CN has limited overall traffic volume data available for the EJ&E Subdivisions for 2008. In addition, subsequent to the acquisition, some CN traffic was re-routed onto the EJ&E lines. For these reasons it was decided that use of 2008 traffic volumes for MGT would not be representative of expected traffic volumes under CN operations. Volumes of TIH/PIH shipments were available for 2008 and these values were slightly higher than the 2009 values so the PTCIP uses 2008 TIH/PIH shipment volumes for the EJ&E lines.

CN completed the integration of EJ&E traffic into CN data systems on July 1st, 2009, giving CN a full 6 months of traffic data for the four EJ&E subdivisions. To calculate traffic volume data (MGT) for the CN PTCIP we have used the available 2009 traffic volume data, pro-rated for a full 12-month period, as the basis for evaluating EJ&E lines against the main line criteria as well as for risk ranking for PTC system implementation for the acquired EJ&E subdivisions (Matteson, Leithton, Lakefront, Illinois River).

6.1.2. P&I Railroad

The P&I Railroad is jointly owned segment between MP 0.0 Burlington Jct. and MP 14.0 P&I Jct. CN, BNSF, and CSX are the owners, UP has trackage rights on it. All CN traffic operating on the Bluford Subdivision uses the P&I Railroad between MP 0.8 Metropolis Jct. and MP 4.1 Chiles Jct. CN traffic data does not contain accurate freight tonnage information on the portion of the P&I RR from 4.1 to 14.0. Further investigation is ongoing to get detailed traffic volumes to perform a final assessment of PTC requirements (redacted material)

6.1.3. CN Network Changes – 2008 to 2010

There have been a number of changes to the nomenclature and organizational structure of CN track segments between 2008 and 2010. Therefore when reviewing data for determination of main line vs non-main line track segments it has been necessary to convert some data from 2008 track segment nomenclature to the current 2010 track segment subdivision names. For the purpose of this PTCIP document, all track segment and subdivision nomenclature is based on the current CN network organizational structure. Specific variances from 2008 to 2010 are as follows:

a) Shelby Subdivision – The Shelby subdivision was created in 2009 when the southernmost portion of the Fulton Subdivision (MP 387.9 to 396.8) and the northernmost portion of the Yazoo Subdivision (MP 13.1 to 5.4) were consolidated and re-named the CN Shelby Subdivision. The newly formed Shelby subdivision is the primary route for CN freight traffic and bypasses Memphis from the Fulton Subdivision on the north to the Yazoo Subdivision on the south. All data used for main line track segment determination as well as weighted risk ranking data for line segment prioritization is based on the 2008 data for the respective portions of the Fulton and Yazoo Subdivisions.

b) Marquette Range Subdivision – The Marquette Range Subdivision in Wisconsin was created in 2009 when the Ore and L'Anse Subdivisions were combined. As unique data is available for both Ore and L'Anse Subdivisions for 2008, each of these have been evaluated separately for the purpose of main line segment determination but any future PTC evaluation of this track will be performed under the new combined Marquette Range Subdivision.

c) Manistique Subdivision – The Manistique Subdivision in Wisconsin was extended in November of 2009 to include all track that was previously part of the Marinette Subdivision. As unique data is available for both the Manistique and Marinette subdivisions for 2008 each of these have been evaluated separately for the purpose of main line segment determination but any future planning or evaluation of this track will be under the new combined Manistique Subdivision.

d) Grenada Subdivision – A large portion of the Grenada Subdivision was sold by CN in 2009. The remaining northernmost portion of the Subdivision (MP 397.47 to 403.00) has been added to the Memphis Subdivision and will be evaluated as part of the Memphis subdivision for purpose of main line track segment determination. The remaining southern portion of the Grenada Subdivision (MP 703.8 to MP 727.2) has been renamed as the Canton Subdivision and any future planning or evaluation of this track will be under this name.

6.2. CN Main Line Track Segments

For the purposes of PTC planning and evaluation, CN has chosen to define a line segment as a subdivision. This decision is based on the following factors:

- CN information and data acquisition systems are aligned with existing subdivision boundaries and therefore provide natural delineation of where PTC evaluation criteria can be readily segmented,
- Train and maintenance operations are aligned with existing subdivision boundaries which will facilitate PTC implementation if deployment schedules and targets are based on a subdivision segmentation of track,
- Subdivision based delineation of track is the common method of segmentation of capital and resources for capital and operating programs. Segmentation of track using different criteria will unnecessarily complicate the specification and tracking of PTC implementation activities,
- Operating corridors between key terminals typically align well with subdivision boundaries which makes them a logical segmentation for PTC project evaluation.

In 2008, CN's U.S. network included 82 subdivisions of track (including EJ&E acquisition) All of these subdivisions were reviewed to determine if they qualified as main line track segments under the RSIA and 49 C.F.R. §236.1003 PTC regulations. Each of the 82 CN subdivisions were evaluated according to the main line track definitions as included in 49 C.F.R. § 236.1003(b) and § 236.1005(b)(1)(i and ii).

§ 236.1003 (b) Definition of Main Line:

"Main line means, except as provided in § 236.1019 or where all trains are limited to restricted speed within a yard or terminal area or on auxiliary or industry tracks, a segment or route of railroad tracks:

(1) Of a Class I railroad, as documented in current timetables filed by the Class I railroad with the FRA under § 217.7 of this title, over which 5,000,000 or more gross tons of railroad traffic is transported annually; or

(2) Used for regularly scheduled intercity or commuter rail passenger service, as defined in 49 U.S.C. 24102, or both. Tourist, scenic, historic, or excursion operations as defined in part 238 of this chapter are not considered intercity or commuter passenger service for purposes of this part."

"***§ 236.1005 Requirements for Positive Train Control systems***

(b) PTC system installation.

(1) Lines required to be equipped. Except as otherwise provided in this subpart, each Class I railroad and each railroad providing or hosting intercity or commuter passenger service shall progressively equip its lines as provided in its approved PTCIP such that, on and after December 31, 2015, a PTC system certified under § 236.1015 is installed and operated by the host railroad on each:

(i) *Main line over which is transported any quantity of material poisonous by inhalation (PIH), including anhydrous ammonia, as defined in §§ 171.8, 173.115 and 173.132 of this title;*

(ii) *Main line used for regularly provided intercity or commuter passenger service, except as provided in § 236.1019…"*

Each of the CN subdivisions were reviewed based on the main line track criteria defined in the RSIA and 49 C.F.R. § 236.1003(b) (1) & (2). Using the 5MGT and regularly scheduled commuter or inter-city passenger train criteria there are 48 CN subdivisions that qualify as main line track segments. The basic steps used to evaluate each subdivision for qualification as a main line track segment were as follows:

1) Include four subdivisions acquired as part of EJ&E transaction, using prorated 2009 MGT and TIH traffic volume information,

2) Evaluate all subdivisions using 2008 MGT traffic volumes. When there were multiple measurement sections for MGT volumes within the subdivision the weighted average of MGT volumes was used and compared to the 5 MGT threshold for defining a main line track segment. Weighted average was based on the following formula:

   Weighted Avg MGT = Sum of (section MGT x section miles) / Subdivision Miles

3) For all subdivisions that fell below the 5MGT threshold using the weighted average formula and where multiple MGT measurement sections were available, each section within the subdivision were evaluated to determine if any sections exceeded 5 MGT. The portions of the subdivision that exceeded 5 MGT were included on the list as main line track segments.

4) All subdivisions were evaluated for the presence of regularly scheduled commuter and inter-city passenger trains. Any subdivision or section of a subdivision with passenger traffic is included as a main line track segment.

5) Subdivisions and subdivision sections that were identified as main line were reviewed to validate and identify portions that fell within yard limits or restricted speed operations. Main line segment mileages were adjusted to reflect these adjustments.

6) Main line track segments that met the criteria for PTC exclusion based on the MTEA exclusion criteria found in 49 C.F.R. § 236.1019 were identified and reviewed with the appropriate passenger train operators. With the concurrence of the passenger train operators, these segments of track have been submit for MTEA exclusion from PTC installation and were removed from the CN main line track segment list.

6.2.1. CN Subdivisions Exceeding 5 MGT in 2008

The subdivisions identified in the table below had either 2008 weighted average traffic volumes exceeding the 5 MGT threshold or segments of the subdivision that had peak traffic volumes that exceeded the 5 MGT threshold.

Table 9 CN Subdivisions with Traffic Volumes over 5 MGT in 2008

Subdivision	2008 Traffic Data				Main Line - Mileages Over 5 MGT				
	Avg MGT	Peak MGT	TIH/PIH Cars	Passenger Trains/Day	From MP	From Station	To MP	To Station	Route Miles

6.2.2. Subdivision Segments Exceeding 5 MGT

Included in the preceding table are a number of subdivisions where 2008 traffic volumes exceed the 5 MGT threshold for only a portion of the subdivision track miles. The subdivision portions that exceed the 5 MGT threshold are identified as follows:

1. (Redacted Material)
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.

The CN main line segments from section 6.3.1 are updated to reflect the revised mileages for main line track segments.

6.2.3. Subdivisions with Regularly Scheduled Passenger Trains

There are a number of CN Subdivisions and portions of Subdivisions that have regularly scheduled passenger traffic (commuter or inter-city). All tracks with regularly scheduled passenger trains qualify as main line and will be included in the summary list of CN main line track segments. These are as depicted in the table below:

Table 10 Line Segments with Regularly Scheduled Passenger Trains

Subdivision	2008 Traffic Data				Passenger Traffic Limits				
	Avg MGT	Peak MGT	TIH/PIH Cars	Passenger Trains/Day	From MP	From Station	To MP	To Station	Route Miles

6.2.4. Restricted Speed Track Revisions to Line Segment Mileages

The mileage limits for the main line segments identified in section 6.2.1 include the full timetable mileage ranges for all tracks included as part of the Subdivision in the CN Operating Timetables. All track within the identified mileage limits has been reviewed to identify any locations where all train operations are limited to restricted speed and would therefore be excluded from being considered main line track as per the definition in 49 C.F.R. § 236.1003(b).

The following list summarizes all subdivisions that have sections of restricted speed track within the identified main line track sections (excluding any restricted speed track segments with regularly scheduled passenger train operations):

Table 11 Line Segments with Restricted Speed Track

Subdivision	Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track in Main Line Limits	Restricted Speed Track (miles)
	From MP	From Station	To MP	To Station	Route Miles		

6.2.5. Final CN Main Line Track Segment Mileages

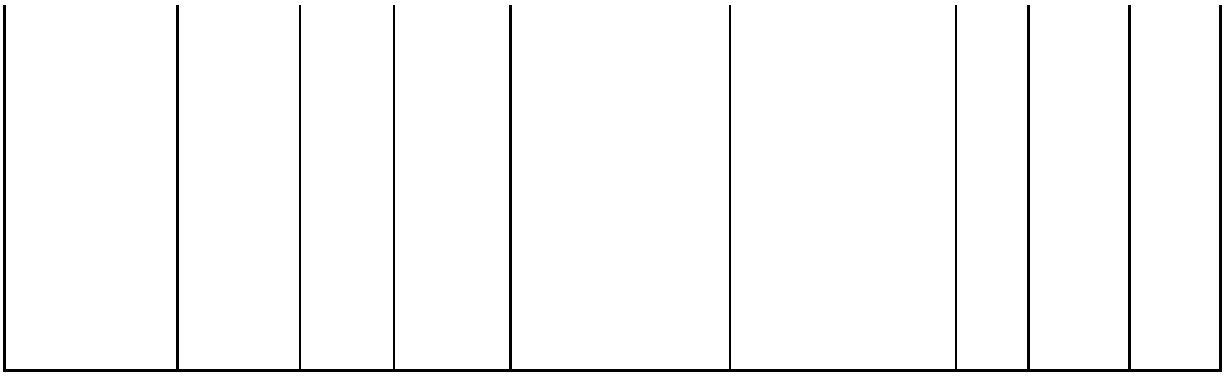
The final CN main line track segment mileages have been identified based on the RSIA and 49 C.F.R. 236 criteria of 5 MGT annual traffic volumes with TIH/PIH traffic or regularly scheduled passenger operations and adjusted to compensate for track that falls within yards or restricted speed operations.

Any portions of restricted speed track where there are regularly scheduled passenger operations, have been noted and are either retained as main line track as required by 49 C.F.R. § 236.1003 or identified as main line track exceptions as permitted under § 236.1019 and are summarized for MTEA submission in section 6.4.

The table bellows provides a consolidated view of all CN main line track based on the requirements of the RSIA as well as 49 C.F.R. § 236.1003 and § 236.1005(b)(1)(i and ii).

Table 12 CN Main Line Track Segments

Subdivision	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Passenger Trains/Day	From MP	From Station	To MP	To Station	Route Miles		



Non-Main Line Track: CN considers all other auxiliary track, branch lines, industrial sidings, low tonnage spurs and other track not included in the map and table above to be non-main line track.

6.3. Summary of Technical Notes on CN Data

As discussed in the preceding text, it was necessary to make a number of decisions and adjustments concerning the data used to determine which track segments that meet the main line track criteria under RSIA and 49 C.F.R. § 236.1003(b) (1) & (2). Following is a summary of these decisions and adjustments:

1. EJ&E Subdivisions use 2009 traffic volumes (MGT) for July to December prorated for a full 12 month period to determine if they meet the 5MGT threshold for main line track. These subdivisions are the Matteson, Leithton, Lakefront and Illinois River. Data was available for 2008 TIH shipment volumes and this data has been used for TIH calculations.

2. When there were multiple measurement sections for MGT volumes within the subdivision, the weighted average of MGT volumes was used and compared to the 5 MGT threshold for defining a main line track segment. Weighted average was based on the following formula:

   Weighted Avg MGT = Sum of (section MGT x section miles) / Subdivision Miles

3. For all subdivisions with weighted averages that fell below the 5MGT threshold and where multiple MGT measurement sections were available, each section within the subdivision was evaluated to determine if any sections exceeded 5 MGT. The portions of the subdivision that exceeded 5 MGT were included on the list as main line track segments.

4. Subdivisions that did not meet the main line criteria (5 MGT) but had passenger train operations on all or a portion of the subdivision had all track mileages with regularly scheduled passenger trains identified as main line.

5. Passenger train volume for all track on a subdivision is based on the average number of daily passenger train movements on the busiest passenger traffic segment of the subdivision.

6. TIH/PIH traffic volumes include both loaded and residue shipments.

6.4. Foreign Owned Line Segments

There are a number of segments of track within the identified main line track segments that are not owned and/or dispatched by CN. These line segments are as follows:

1. (Redacted Material)
2.
3.
4.

These track segments will be carried forward in this PTCIP document as CN track segments for the purpose of PTC risk factor analysis and PTC deployment planning. Actual responsibility for PTC installation will reside with the "host railroad" which as specified in § 236.1005(b) is the railroad that has effective operating control over the segment. CN will engage in discussions with the responsible corporate entities to ensure they are aware of the associated PTC requirements as appropriate.

6.5. MTEA Requests

This section includes details of the specific track segments that meet the criteria defined in 49 C.F.R. 236 to qualify as a main line track segment but for which CN is requesting Mainline Track Exclusion Addendums as defined § 236.1019. Each MTEA request is detailed separately in the following sections but all have been reviewed in detail with the applicable passenger train operators and all are submit with their full concurrence and agreement. Each MTEA submission provides a summary track description and layout as well as a narrative description of the normal train operations and a reference to the applicable section of 49 C.F.R. § 236.1019 that the MTEA is requested under.

MTEA requests being applied for by CN are covered by one of the following exception conditions:

1. 49 C.F.R. § 236.1019 (c)(1)(i) – the track is used for limited operations by at least one passenger railroad with all trains limited to restricted speed,

2. 49 C.F.R. § 236.1019(c)(3) – not more than four passenger trains per day are operated on a segment of track of a Class 1 freight railroad on which less than 15 million gross tons of freight traffic is transported annually.

The following list provides an overview of the MTEA's being requested by CN:

(Redacted Material)

Each of the track segments identified above have been excluded from the CN main line track segment list and have also been excluded from PTC risk factor evaluation and PTC deployment scheduling (sections 7 & 8 of this document).

Details on all MTEA requests are included in Section 13 of this document.

7. Installation Risk Analysis [§ 236.1011(a)(4)]

This section describes how CN will comply with 49 C.F.R. 236, Subpart I, § 236.1011(a)(4), which requires the deployment of PTC in areas of greater risk to the public and railroad employees before areas of lower risk.

7.1. The Rail Network

The CN rail network is illustrated in the map in section 1.

Of the 48 subdivisions that meet the main line track criteria (see section 6) six subdivisions did not have any passenger trains or TIH/PIH traffic (loads or residue) in 2008 and therefore were eliminated from the CN PTC. In addition, the (Redacted Material) is covered by an MTEA request, and has therefore been removed from the implementation planning and risk prioritization process. The table below identifies the resulting 41 CN subdivisions that are considered main line track segments requiring PTC and will be evaluated for installation risk prioritization per the model in Appendix B. This table excludes portions of track identified to be within yard limits where all train operations are limited to restricted speed (see section 6).

Table 13 CN Main line Track segments – Excluding MTEA Tracks

Subdivision	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Passenger Trains/Day	From MP	From Station	To MP	To Station	Route Miles		

7.2. Risk Factors, Risk Factor Levels, and Risk Factor Weights

The risk prioritization model used by CN is based on a risk evaluation methodology that was developed through a cooperative effort between a number of the Class 1 railways working with the Rail Safety group at Battelle. The prioritization model incorporates a basic weighted score approach in which a number of risk factors were assigned integer scores, corresponding with level of risk, ranging from 0 (lowest risk) up to 5 (highest risk) for each of the CN subdivisions to be equipped with PTC. Each risk factor was also assigned a weight, which provided an indication of the "relative importance" of the factor in determining the overall risk ranking. Equation 1 below shows how, for *n* risk factors, a relative risk score was generated for each subdivision by multiplying the integer score assigned to the subdivision for a given factor (FR_i) by the weight assigned to that factor (FW_i), and summing the products of the *n* risk factors.

(Equation 1) *Relative Risk Score for Subdivision* $\sum_{i=1}^{n} FR_i FW_i$

In order to perform the above calculation, the following activities were undertaken:

1. Identify risk factors to be included in the risk prioritization model;
2. Estimate the risk factor weights (FW_i); includes subjective assessment of risk probability and risk consequence;
3. Define the ranges of data for each of the 6 risk factor levels (0 – 5) that would be used to assign scores to the subdivisions for each risk factor; The lower and upper limits of the data defined for each risk factor level reflect a normalized range as determined by CN;
4. Assign integer scores (FR_i) to each subdivision using the criteria defined in #3 above.

The FRA Risk Prioritization Methodology for PTC System Implementation includes a list of risk factors, which it identifies as "minimum critical risk factors that must be addressed" in the risk prioritization model. These eight risk factors, which are listed below, correspond with the risk factors identified in §236.1011(a)(5) as minimum factors that will be used in the consideration of the order the track segments will be equipped; CN evaluated these eight risk factors in the risk prioritization model.

7.2.1. Risk Factor 1: Annual Million Gross Ton (MGT)

(Redacted Material)

Table 14 Annual MGT Risk Factor Levels

Factor Levels for Annual MGT Level		
Factor Level	**Lower Limit**	**Upper Limit**

7.2.2. Risk Factor 2: Presence and Volume of Passenger Traffic

(Redacted Material)

Table 15 Daily Passenger Train Risk Factor Levels

Factor Levels for Presence and Volume of Passenger Traffic		
Factor Level	**Lower Limit**	**Upper Limit**

7.2.3. Risk Factor 3: Presence and Volume of TIH/PIH Material (Loads and Residue) Transported

(Redacted Material)

Table 16 Annual Car Volume of TIH/PIH Risk Factor Levels

Factor Levels for Presence and Volume of TIH/PIH Material (Loads and Residue) Transported		
Factor Level	**Lower Limit**	**Upper Limit**

7.2.4. Risk Factor 4: Number of Tracks

(Redacted Material)

Table 17 Numer of Tracks Risk Factor Levels

Factor Levels for Number of Tracks		
Factor Level	**Lower Limit**	**Upper Limit**

7.2.5. Risk Factor 5: Method of Operation

(Redacted Material)

Table 18 Methods of Operation Risk Factor Levels

Factor Levels for Method of Operation	
Factor Level	**Description**

7.2.6. Risk Factor 6: Speed of Train Operations

(Redacted Material)

Table 19 Train Speed Risk Factor Levels

Factor Levels for Speed of Train Operations		
Factor Level	**Lower Limit**	**Upper Limit**

7.2.7. Risk Factor 7: Track Grades

(Redacted Material)

Table 20 Track Grade Risk Factor Levels

Factor Levels for Track Grades		
Factor Level	**Lower Limit**	**Upper Limit**

7.2.8. Risk Factor 8: Track Curvature

(Redacted Material)

Table 21 Track Curvature Risk Factor Levels

Factor Levels for Track Curvature		
Factor Level	**Lower Limit**	**Upper Limit**

(Redacted Material)

Table 22 Risk Factor Weights

RF #	Risk Factor	Weight
1	Annual Million Gross Ton (MGT)	
2	Presence and Volume of Passenger Traffic	
3	Presence and Volume of TIH/PIH Material (Loads and Residue) Transported	
4	Number of Tracks	
5	Method of Operation	
6	Speed of Train Operations	
7	Track Grades	
8	Track Curvature	

(Redacted Material)

7.3. Overall Risk Ranking

(Redacted Material)

Table 23 Risk Factor Priority Ranking

Risk Factor Priority (1-5)	Relative Risk Score

(Redacted Material)

Table 24 Line Segment Risk Ranking

Num	Subdivision	Avg MGT	Peak MGT	TIH/PIH Cars	Passenger Trains/Day	Mainline Route Miles	Risk Factor Group	Weighted Priority

Risk Factor Groupings - Based on Weighted Average of Risk Factors

8. Deployment Sequence and Schedule [§ 236.1011(a)(5)]

This section details the sequence, planned schedule, and decision criteria for equipping line segments with PTC based on the weighted risk ranking analysis from the previous section. Also included is the proposed schedule for commencing revenue-service PTC operations by December 31, 2015, on all line segments identified as requiring PTC installation.

8.1. CN Key Service Corridors

CN's track network in the US is generally "Y" shaped with arms extending from Ranier, Minnesota and Port Huron, Michigan that meet in Chicago. The CN network then runs southward from Chicago to New Orleans to complete the "Y". Each segment of the "Y" is typically a linear network with little option for alternate traffic routing within the CN network.

Subdivisions and tracks comprising each leg of the CN "Y" form a service corridor and our scheduled train service operation is based on the performance of our trains through each of these corridors. This corridor based train service delineation naturally generates a similar alignment for our field engineering and maintenance activities. To support our train service corridors, CN has also aligned our internal data and information systems and our managerial organizational structure along the corridor concept as well.

8.2. CN PTC Corridor Deployment Approach

The PTC implementation target is very aggressive and CN wants to ensure that we are able to complete the program within the established schedule by taking advantage of every opportunity possible to improve both the efficiency and effectiveness of the resources allocated to the PTC deployment program as well as the utilization of PTC systems and equipment. One of the ways that this can be achieved is to group main line track segments that require PTC into deployment groupings that align with our existing service corridors or are geographically proximate to the service corridor. This will also assist in using existing systems and data for project metrics and reporting. Prioritization of the deployment groupings will be based on a weighted average of the core main line track segments that form the Service Corridor.

This grouping was done to accommodate a practical approach to the overall system deployment. Rather than attempt a haphazard deployment based solely on subdivision risk ranking, this grouping allows CN to simplify deployment logistics by keeping installation, test, and maintenance crews together as a larger section of the railroad is equipped and PTC is deployed into service. This approach also allows the railroad to take advantage of any PTC benefits sooner since larger, more integrated, sections of the railroad will be equipped and placed into service at a time.

8.3. CN Deployment Groupings

CN has developed 5 PTC line segment deployment groupings based on the service corridors and geographically adjacent proximate subdivisions. These deployment groupings are depicted on the following map and described below.

(Redacted Material)

Figure 2 PTC Deployment Groupings

8.3.1. Pilot Deployment Group: (Redacted Material)

Table 25 Pilot Deployment Group

Pilot Deployment Group	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Psgr Trains	From MP	From Station	To MP	To Station	Route Miles		

8.3.2. Deployment Group: (Redacted Material)

Table 26 Deployment Group

Deployment Group	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Psgr Trains	From MP	From Station	To MP	To Station	Route Miles		

8.3.3. Deployment Group: (Redacted Material)

Table 27 Deployment Group

Deployment Group	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Psgr Trains	From MP	From Station	To MP	To Station	Route Miles		

8.3.4. Deployment Group: (Redacted Material)

Table 28 Deployment Group

Deployment Group	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Psgr Trains	From MP	From Station	To MP	To Station	Route Miles		

8.3.5. Deployment Group: (Redacted Material)

Table 29 Deployment Group

Deployment Group	2008 Traffic Data				Main Line - Over 5MGT or Passenger Traffic					Restricted Speed Track (miles)	Main Line (Route Miles)
	Avg MGT	Peak MGT	TIH/PIH Cars	Psgr Trains	From MP	From Station	To MP	To Station	Route Miles		

8.4. Deployment Group Weighted Risk Ranking [§ 236.1011(a)(5)(iii)]

RSIA and FRA's regulations at 49 C.F.R. § 236.1011(a)(4) require that PTC be deployed, to the extent practical, in areas of greater risk to the public and railroad employees before areas of lower risk. All of the CN main line track segments that require PTC installation were evaluated using the risk ranking methodology described in section 7 of this document. The risk ranking was performed using the risk factors as required in 49 C.F.R. § 236.1011(a)(5), to establish risk ratings for each CN subdivision where PTC is required.

CN is using a risk based deployment sequence for staged implementation of PTC on its territories. The analysis provided in Section 7 of this PTCIP is used as the basis for the sequence. As previously discussed, CN has arranged its subdivisions requiring PTC installation into 5 deployment groups and a summary risk ranking for each deployment group of subdivisions was tabulated and used to determine which group would be prioritized first.

The summary risk ranking was calculated based on a weighted average of the line segment weighted risk rankings from Section 7 for all of the subdivisions that formed part of the service corridor or had passenger train operations (excludes the geographically proximate subdivisions which typically have less traffic and no passenger operations). The summary risk ranking values for the 5 deployment groups are as shown below.

(Redacted Material)

Note: The summary deployment group risk ranking value was calculated using the equation below:

$$SummaryRiskRanking = \sum_{i=1}^{n} SRiSMi \Big/ \sum_{i=1}^{n} SMi$$

where: n = number of line segments in the deployment group
SRi = line segment risk ranking
SMi = line segment route miles

As shown by the summary risk rankings above, with the exception of the (Redacted Material) deployment group the risks are essentially equal throughout the CN deployment groups. From this conclusion and other considerations, CN has chosen to install the PTC system starting in a manner that not only aims to reduce safety risk, but also reduces the installation physical risks, the financial risks, and the risks of adverse PTC impact on the normal operations of the railroad. This group deployment strategy is discussed further in Section 8.8.

8.5. Deployment Group Traffic Characteristics [§ 236.1011(a)(5)(i)]

(Redacted Material)

Table 30 Deployment Group Traffic Characteristics

Deployment Group	2008 Traffic Data				
	Weighted Avg MGT	Peak MGT Segment	Annual TIH/PIH Cars	Annual Other Hazmat	Annual Passenger Miles

(Redacted Material)

8.6. Deployment Group Operational Characteristics [§ 236.1011(a)(5)(ii)]

(Redacted Material)

Table 31 Deployment Group Operational Characteristics

Deployment Group	Method of Operations					Miles of Main Track					Max Train Speed
	TCS	ABS/ TWC	TWC	Yard/ 520	Total Miles	Main1	Main2	Main3	Main4	Total Miles	

(Redacted Material)

8.7. Deployment Group Attributes [§ 236.1011(a)(5)(iii)]

(Redacted Material)

8.7.1. Grade, Curvature, Switches & Road Crossings

(Redacted Material)

Table 32 Grade, Curvature, Switches & Road Crossings by Deployment Group

Group	Track Attribute							
	Road Crossings		Switches		Max Grade	Curves		Route Miles	Track Miles
	Total	Num/Mile	Total	Num/Mile	(Percent)	Total	Num/Mile		

(Redacted Material)

8.7.2. Rail to Rail Crossings at Grade

(Redacted Material)

Table 33 Rail to Rail Crossings at Grade by Deployment Group

Deployment Group	Railway Crossings at Grade

8.7.3. Movable Bridges

(Redacted Material)

Table 34 Movable Bridges by Deployment Group

Deployment Group	Movable Bridges		
	Subdivision	Mileage	Description

8.7.4. Passenger Operations

(Redacted Material)

Table 35 Annual Passenger Train Operations by Deployment Group

Passenger Train Summary - Annual by Deployment Group					
Deployment Group	Amtrak		Metra		Total Passenger Miles (Est.)
	Total Trains	Total Miles (Est.)	Total Trains	Total Miles (Est.)	

(Redacted Material)

(Redacted Material)

Table 36 Passenger Stations by PTC Deployment Group

Deployment Group	Passenger Station Summary			
	Amtrak		Metra	
	Stations	Corridor	Stations	Corridor

8.7.5. Presence of Other Traffic – Shared Routes

(Redacted Material)

Table 37 Shortline Traffic by Deployment Group

Group	Subdivision	Shortline RailRoad Running Rights Agreements				
		Railway	MP From	MP To	Trains /Week	Description

(Redacted Material)

8.8. Proposed Deployment Schedule

(Redacted Material)

(Redacted Material)

Figure 6 CN PTC Deployment Schedule

8.9. Exceptions to Risk Based Prioritization [§ 236.1011 (a)(9)]

The final PTC rule Section §236.1011 (a)(4) requires that, to the extent practical, the PTC system be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk. The following discussion provides details on how the proposed CN PTC deployment plan varies from a pure line segment by line segment risk based PTC implementation.

8.9.1. Corridor Deployment

(Redacted Material)

8.9.2. Geographically Proximate Subdivisions

(Redacted Material)

8.9.3. Subdivisions with Limited Segments of Passenger Operations

(Redacted Material)

8.10. De-Minimis Exception Requests [§ 236.1005 (b)(4)(ii)]

CN has several track segments that have low freight volumes and minimal volumes of TIH/PIH traffic. These track segments are identified below and are included in section 14 of this document as De-Minimis PTC exclusion requests.

The following list provides an overview of the De-Minimis exclusions being requested by CN:

(Redacted Material)

CN has fully included all of the above subdivisions in its PTCIP line segment ranking and risk evaluation criteria. All of the these subdivisions are currently included in the CN PTCIP deployment plan and will be maintained as part of CN's PTC deployment plan until such time as approval of the De-Minimis exclusion request may be received from the FRA.

Details on all De-Minimis exclusions are included in Section 14 of this document.

8.11. Redacted Material

Redacted Material

Redacted Material

Redacted Material

9. Rolling Stock [§ 236.1011(a)(6)]

This section contains information related to the CN rolling stock that will be equipped with the PTC technology.

9.1. CN Locomotive Fleet Overview

The CN locomotive fleet consists of a total of (Redacted Material) locomotives built by either General Electric Transportation (Erie, Pennsylvania) or Electromotive Diesels (LaGrange, Illinois). All CN locomotives utilize DC traction motor technology and are classified as either Low Horsepower (LHP - under 3,000 horsepower) or High Horsepower (HHP - 3,000 horsepower and greater). Low horsepower locomotives are normally assigned to designated yard or terminal operations while the high horsepower locomotive fleet is not normally assigned to any designated service. The active locomotive fleet at any given time will vary depending on the current traffic levels and operating service plan requirements.

In developing its PTC Implementation Plan, CN reviewed its overall locomotive fleet assignments as well as our operating service plan to determine the best strategy for meeting its PTC objectives. The option of segmenting our HHP locomotive fleet into Canadian and US assignments to reduce PTC implementation costs was considered but rejected in favour of a more aggressive plan to equip the majority of the HHP locomotives. This plan will ensure that trains operating across the border from Canada will have PTC equipped locomotives when they enter the United States.

The table below provides a snapshot of the CN locomotive fleet at the time of submission of this PTC Implementation Plan.

Table 38 CN Locomotive Fleet

Horse Power	No. of Units
HHP	
LHP	
Total	

9.2. Locomotives to be PTC Equipped [§ 236.1011(a)(6)(i)]

As part of the PTC implementation initiative, CN will equip 820 of our HHP locomotives with PTC as well as 180 US assigned yard and road switcher locomotives by 31 December 2015. The table below provides the summary of locomotives that will have PTC equipment installed:

Table 39 PTC Equipped Locomotives

Model	HP	Inv Tot	PTC Eqp

Once all PTC implementations are completed, CN will have equipped over 98% of its total HHP mainline freight road haul locomotives and 85 % of its LHP fleet assigned to US operations. This will provide adequate PTC equipped locomotives to support all CN freight and work train operations as well as local and yard switching operations on PTC equipped tracks.

9.3. PTC Implementation Schedule [§ 236.1011(a)(6)(ii)]

In 2010, a pilot program is planned to equip six (6) EMD and six (6) GE High Horsepower locomotives with PTC equipment. The purpose is to assess and evaluate the optimum equipment layout and installation procedure on two of our key types of HHP road locomotives.

Full scale rollout of PTC installation on the CN HHP locomotive fleet is scheduled to start in 2011 with 123 locomotives and then ramp up to an average of approximately 170 locomotives per year in 2012, 2013, 2014. The remainder of the HHP locomotives will be completed in 2015. The table below provides more details on the overall locomotive implementation plan.

Installation of PTC equipment on Low Horsepower locomotives will be completed in four (4) groups, with the first group scheduled for conversion in 2011 and successive groups scheduled in 2013, 2014, 2015. Equipping of LHP locomotives has been minimized in the first two years of the rollout to help ensure availability of resources to focus priority in 2011 and 2012 on equipping the HHP fleet.

The schedule for installation of PTC onboard equipment is as follows:

Table 40 PTC Onboard Installation Schedule and % Completion

Year	HHP	LHP	Total	% HHP	%LHP	Total %
2010	12	0	12	1%	0%	1%
2011	123	52	175	16%	29%	19%
2012	210	0	210	42%	29%	40%
2013	158	58	216	61%	61%	61%
2014	151	40	191	80%	83%	80%
2015	166	30	196	100%	100%	100%
Total	820	180	1000			

Whenever possible, locomotive PTC modifications will be performed when a locomotive is in one of CN's main running repair shops for major repairs, overhauls or quadrennial inspections. Aligning PTC equipment installation in conjunction with these other activities will assist in scheduling PTC installation activities and help ensure that service impacts are minimized while locomotives are out of service for upgrades.

Installation of PTC equipment on CN locomotives will be performed by CN employees whenever possible. Technical assistance and guidance will be provided by technical service personnel from the PTC equipment suppliers or other industry technical resources as required. In the event the internal CN resources are inadequate to maintain the forecast PTC equipment implementation schedule, CN will contract equipment installation activities to external contract facilities as required. Prior to contracting PTC equipment installation activities, CN will undertake a review and assessment of the technical expertise and ability of the external facility to undertake the PTC installation workload.

As locomotives attrite from the CN fleet, they will be removed from the PTC implementation plan and other locomotives added to maintain the overall targeted number of PTC equipped

locomotives. In the future, if locomotive manufacturers become capable of supplying new locomotives that are PTC equipped and enabled from the factory, CN will pursue this option for new locomotive purchases as a component of our strategy for achieving locomotive PTC implementation targets.

In accordance with rule § 236.1006(b)(2) CN will report its progress toward achieving its planned PTC locomotive deployment by April 16, of years 2011, 2012, 2013, and 2014.

9.4. Tenant Railroads [§ 236.1011(a)(6)(iv)(A) and (B)]

Tenant railroads operating on CN track include most of the Class 1 freight railroads, Amtrak and Metra, and the Class 2 and Class 3 railroads that have been identified in section 5 of this document.

For the purpose of this PTCIP submission, CN has signed Interoperability Agreement letters with Amtrak and Metra as well as all of the other Class 1 railways. CN is also working with all the Class 1 railroads through the ITC process. All primary tenants, that is, Class 1 freight railroads, Amtrak and Metra are submitting PTCIP documents independently. Thus, in accordance with rule § 236.1011(a)(6)(iv), CN will not be filing the details of their rolling stock nor their deployment plans in its own submission.

Class 2 and Class 3 tenant railroads are not required to be PTC-equipped by rule § 236.1006(b)(i-iii), and therefore, there is no deployment information on these tenant railroads available. CN will work closely with all Class 2 and Class 3 tenant railroads to ensure they are informed of our PTC implementation plans.

10. Wayside Devices [§ 236.1011(a)(7)]

As described in section 1.1, the CN PTC system is a locomotive-centric train control system that uses a combination of locomotive, office, and wayside data integrated via a radio network. This section identifies the wayside devices and subsystems that will be installed as part of the CN PTC System.

10.1. Wayside Device Equipment

The two major wayside devices are the Wayside Interface Unit (WIU) and the Wayside/Base Communication Packages (BCP).

10.1.1. Wayside Interface Units

The WIU is a vital device that reads the real time status of specific interlocking devices(signals and switches), creates pre-programmed messages derived from this data, and transmits this data from the WIU to the locomotive and/or office subsystems of the PTC system using the wayside/base communication network.

Depending on the method of train control (CTC, Track Warrant ABS or Track Warrant), CN is to install ITC specification compliant WIUs at wayside locations as shown in Table 41.

Table 41 WIU Installations	Method of Control		
	CTC	Track Warrant ABS	Track Warrant
Control Points	Yes		
Intermediate & Approach Signals	Yes	Yes	Yes
Entering Signals	Yes	Yes	
Interlockings	Yes	Yes	Yes
Moveable Bridges	Yes	Yes	Yes
Hand Throw Switches			Yes

The table of Wayside Device Tabulations in section 10.2 provides an estimate of the anticipated WIUs per subdivision.

CN anticipates the use of both stand-alone and integrated WIU platforms.

Stand alone WIUs are designed to monitor signal devices directly and are therefore well suited to installation at hand throw switches in track warrant territory, relay controlled signals, control points and interlockings, and at locations with electronic control equipment that cannot be upgraded to provide WIU functionality. CN expects that this equipment will be employed at approximately (Redacted Material) of WIU locations.

Integrated WIU platforms are designed as an extension of existing electronic control equipment, commonly adding WIU functionality through an upgraded CPU card. In this case, the control equipment monitors the state of the signal devices and passes this information vitally to the portion of the CPU card implementing the WIU functionality. CN expects that this equipment will be employed at approximately (Redacted Material) of WIU locations.

10.1.2. Wayside/Base Communications Packages

The wayside data communications (or base communication packages) will be via a 220MHz narrowband wireless network. It is the industry-standard private radio implementation, specified and designed by the ITC consortium. The private 220MHz network will support communications between the office, locomotive, and wayside subsystems and will utilize spectrum owned and managed by the ITC consortium. The base communication packages will be comprised of the following major components, each performing one of the BCP's primary functions: RF transceiver, RF transmission interface, wireline interface, radio interface and antenna system. These BCPs will be located across the subdivisions as required by the design; the table of Wayside Device Tabulations in section 10.2 provides an estimate of the anticipated BCPs per subdivision.

10.2. Wayside Device Tabulations

The following table provides a tabulation of the projected number of major wayside devices (WIUs and BCPs) to be installed by subdivision.

Table 42 Wayside Device Tabulations

Deployment Group	Subdivision Name	From MP	From Station	To MP	To Station	# WIUs	# BCPs

Deployment Group	Subdivision Name	From MP	From Station	To MP	To Station	# WIUs	# BCPs

10.3. Schedule of Installation Milestones

In 2010, CN is to equip six (6) locations from the pilot deployment group with WIUs. The intent is to assess and evaluate the equipment and the procedures for design, installation and maintenance.

Full scale PTC installation is scheduled to start in 2011, with the completion of the various deployment groups, outlined in section 8, scheduled as follows:

Table 43 Percentage of WIUs and BCPs Installed

Deployment Group	% of WIUs Installed	% of BCPs Installed	Scheduled Completion
	9	9	31 December, 2011
	30	33	31 December, 2012
	50	57	31 December, 2013
	66	67	31 December, 2014
	100	100	31 December, 2015

Installation of wayside PTC equipment is to be performed by CN employees whenever possible. Technical assistance and guidance will be obtained from field support personnel from the PTC equipment suppliers and other technical resources as required. In the event that internal CN resources are inadequate to maintain the forecast PTC equipment implementation schedule, CN will contract equipment installation activities to external firms as required. Prior to contracting PTC installation activities, CN will undertake a review and assessment of the technical expertise and ability of the external firm to undertake the PTC installation workload.

In accordance with rule § 236.1006(b)(2) CN will report its progress toward achieving its planned PTC WIU deployment by April 16, of years 2011, 2012, 2013, and 2014.

11. Submittal Dates for PTCDP and PTCSP [§236.1011(a)(10)]

Based on the PTC deployment plan (see section 8) CN anticipates using an unmodified V-ETMS Type Approval (per §236.1009(b)(1)) for its PTC system. On March 24, 2010, UP, NS, and CSXT submitted a PTCDP for the V-ETMS platform. The platform described in that PTCDP is identical to the platform that CN intends to use. As of the date of completion of CN's PTCIP, FRA had not granted a Type Approval number for the V-ETMS platform described in the PTCDP. Accordingly, CN is resubmitting that PTCDP with this PTCIP.

PTC Implementation Plan	by April 16, 2010
PTC Development Plan, if no previously issued Type Approval	by April 16, 2010
PTC Safety Plan Definition Document*	September 2010
PTC Safety Plan	July 2012 **
RFA to either PTCIP***, PTCDP, or PTCSP	As appropriate per Rule

* This document (PTC SPD) would describe the intended organization and content of the CN PTCSP document. The PTC SPD would explain how the Safety Program for CN PTC will, in particular, approach the PTC SP requirements covered under FRA Part 236H and Part 236I. This can be used to provide the FRA with advanced knowledge of CN's planned approach to each referenced Part 236I rule paragraph, and to obtain FRA feedback as to the correctness of the interpretation of the Rule.

** This is an approximate date based on the current deployment schedule found in Figure 8.8. It corresponds to the completion of the safety server installation, which is the final element required to certify the Pilot Group deployment. Should there be a variation to this deliverable, it will be included in a future RFA.

*** As required by the final Rule under §236.1011(f), The PTCIP will be maintained to reflect CN's most recent PTC deployment plans until all PTC system deployments required under Subpart I are complete.

12. Strategy for Full PTC System Deployment [§ 236.1011(b)]

CN has identified all subdivisions that require PTC deployment to comply with 49 C.F.R. part 236, subpart I and plans to equip them with PTC during the primary implementation period, per the schedule found in section 8.

CN's strategy for full PTC deployment is to evaluate the economic and safety benefits derived from the deployment of PTC on the required subdivisions before making any long term plans beyond the subdivisions required by the rule. Criteria similar to the risk priority parameters stated in Section 7 of this PTCIP may be used in the future to determine if additional elective PTC deployment will be undertaken. Given the extensive effort to equip the mandated subdivisions, such evaluation will be deferred until after the primary implementation period.

CN will also review subdivision traffic patterns as part of its Risk Reduction Program on an annual basis to determine if additional PTC deployment becomes required under the rule on any subdivision.

13. Main Line Track Exclusion Addendum [§ 236.1019]

13.1. MTEA General

This Mainline Track Exclusion Addendum seeks to have designated as not "main line" 6 segments of CN's track used for scheduled intercity passenger service. These requests are made pursuant to and would be subject to the conditions set forth in 49 C.F.R. § 236.1019(c).

The following limited operations exceptions apply to this MTEA:

- 49 C.F.R. § 236.1019(c)(1)(i) – the track is used for limited operations by at least one passenger railroad with all trains limited to restricted speed,
- 49 C.F.R. § 236.1019(c)(1)(iii) – not more than four passenger trains per day are operated on a segment of track of a Class 1 freight railroad on which less than 15 million gross tons of freight traffic is transported annually.

Each request in this MTEA is separately presented in detail in the following sections. Each has been reviewed and approved by Amtrak, which is the sole passenger train operator on these lines, and all are submitted jointly with Amtrak's full concurrence and agreement. Each request includes a summary track description and layout as well as a narrative description of the normal train operations and a reference to the applicable section of 49 C.F.R. **§** 236.1019(c).

A main line track exception is requested by CN for each of the following track segments:

(Redacted Material)

Detailed information for each request is provided in the sections below.

13.2. MTEA Request –

(Redacted Material)

13.2.1.

(Redacted Material)

13.2.2.

(Redacted Material)

13.2.3.

(Redacted Material)

(Redacted Material)

13.3. MTEA Request –

(Redacted Material)

(Redacted Material)

13.4. MTEA Request –

(Redacted Material)

13.5. MTEA Request –

(Redacted Material)

(Redacted Material)

13.6. MTEA Request –

(Redacted Material)

(Redacted Material)

13.7. MTEA Request –

(Redacted Material)

(Redacted Material)

14. De Minimis Track Exclusion Requests [§ 236.1005]

14.1. De Minimis General

Section § 236.1005(b)(4)(ii) of the final PTC rule provides an exception to PTC implementation for lines with de minimis TIH/PIH risk. The section allows railroad to request review of the requirement for installation of PTC on a low density track segment where PTC would otherwise be required but has not yet been installed.

The rule establishes criteria that must be satisfied for a de minimis track exclusion request to be considered. The primary de minimis criteria for track segments to be considered for an exclusion request is that it carry less than 100 cars of TIH/PIH material (load and residue) per year § 236.1005(b)(4)(ii)(A).

If a track segment meets the minimum TIH/PIH carload criteria and absent of any other special circumstance, an exclusion request will typically be granted if the following additional criteria are met § 236.1005(b)(4)(ii)(B).

1. Track consists of Class1 or Class 2 track - § 236.1005(b)(4)(ii)(B)(1),
2. Track carries less than 15 MGT annually - § 236.1005(b)(4)(ii)(B)(2),
3. Track has a ruling grade less than 1 percent - § 236.1005(b)(4)(ii)(B)(3),
4. Temporal separation of TIH/PIH traffic - § 236.1005(b)(4)(ii)(B)(4).

For line segments that meet the minimum 100 TIH/PIH carload criteria as well as the maximum 15 MGT total traffic volume criteria but do not meet the other de minimis exclusion criteria (track class, grade and temporal separation) an exclusion request may still be submit for consideration if the railroad can show that risk mitigations will be applied that will ensure the risk of release of TIH/PIH materials is negligible §236.1005(b)(4)(ii)(C).

The issue of negligible risk of TIH/PIH release is one that CN wishes to discuss further with the FRA. CN believes that there is a need to develop and specify a common methodology and tools that can be used by the railway and the regulatory agencies to assess and define what constitutes negligible risk. CN is willing to commit time and resources to working with the FRA and other parties as appropriate to achieve this objective. It is CN's intention to use the established tools and methodology to review and confirm the de minimis exclusion requests being put forward in this implementation plan.

CN has several track segments that are less than 15 MGT of annual freight traffic with minimal volumes of TIH/PIH and no passenger operations that meet the criteria for a de minimis based review of PTC implementation requirement. Each track segment proposed for a de minimis based PTC requirement review is presented separately in the following sections. Each request includes a map of the track covered, a summary track description and layout as well as a narrative description of the normal train operations.

The proposed track segments are:

(Redacted Material)

14.2. De Minimis Request –

(Redacted Material)

(Redacted Material)

(Redacted Material)

14.3. De Minimis Request –

(Redacted Material)

(Redacted Material)

(Redacted Material)

14.4. De Minimis Request –

(Redacted Material)

(Redacted Material)

(Redacted Material)

Appendix A:
Line Segment Attributes Detailed Tables

Appendix A: Line Segment Attributes Detailed Tables

Table 44 Traffic Characteristics by Deployment Group

Deployment Group	Subdivision	2008 Traffic Data				
		Avg MGT	Peak MGT	TIH/PIH Cars	Other Hazmat	Psgr Trains

Table 45 Operating Characteristics by Deployment Group

Deployment Group	Subdivision	Method of Operations					Miles of Main Track					Max Train Speed
		TCS	ABS/ TWC	TWC	Yard/ 520	Total Miles	Main1	Main2	Main3	Main4	Total Miles	

Table 46 Track Attributes Table

Group	Subdivision	Track Attribute									
		Road Crossings				Switches		Max Grade	Curves		Route Miles	Track Miles
		Total	Controlled Switches	Hand Throw Switches	Num/Mile	Total	Num/Mile	(Percent)	Total	Max(Deg)		

Table 47 Deployment Group Attributes – Railway Crossings

Deployment Group	Railway Crossings at Grade					
	Subdivision	Mileage	CN Speed	Other RR	Mntce RR	Description

Deployment Group	Railway Crossings at Grade					
	Subdivision	Mileage	CN Speed	Other RR	Mntce RR	Description

Table 48 Passenger Train Operations

Passenger Train Summary - Annual					
Subdivision	Amtrak		Metra		Total Passenger Miles (Est.)
	Total Trains	Total Miles (Est.)	Total Trains	Total Miles (Est.)	

Table 49 Metra Passenger Train Summary

Metra Passenger Train Summary							
Subdivision	From Station	From MP	To Station	To MP	Metra Daily Trains (one-way)	Miles	Metra Miles/Yr (Est.)

Table 50 Amtrak Passenger Train Summary

Amtrak Passenger Train Summary							
Subdivision	**From Station**	**From MP**	**To Station**	**To MP**	**Amtrak Daily Trains (one-way)**	**Miles**	**Amtrak Miles/Yr (Est.)**

APPENDIX B:
RISK FACTOR PRIORITIZATION MODEL

Appendix B: Risk Factor Prioritization Model

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1. Introduction

This document describes the risk prioritization model generated in response to 49 C.F.R. § 236.1011(4), which requires that, to the extent practical, the positive train control (PTC) system be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk. The risk prioritization model assesses a number of key risk factors, which are assumed to provide an indication of the relative risk associated with the CN subdivisions for which PTC deployment is required by Subpart I § 236.1005(b). The relative risk rankings generated by the risk prioritization model provided the basis for prioritizing deployment of PTC on the CN subdivisions for which PTC is required by Subpart I § 236.1005(b). The risk prioritization model did not assess other CN subdivisions for which PTC deployment is not required by Subpart I §236.1005(b). This document describes the risk prioritization approach, the risk factors that were assessed, and the model results.

The risk factor prioritization model described in this document and used by CN was developed through a cooperative effort between a number of Class 1 Railways working with the Rail Safety group at Battelle.

2. Risk Prioritization Model Approach

The risk prioritization model used by CN is based heavily on the sample methodology provided by the Federal Railroad Administration (FRA) in the *Risk Prioritization Methodology for PTC System Implementation* [2] (hereafter referred to as the *Risk Prioritization Template*). This is a basic weighted score approach in which the minimum critical risk factors identified in the *Risk Prioritization Template* and *PTC Implementation Plan Template* [3], were assigned integer scores, corresponding with level of risk, ranging from 0 (lowest risk) up to 5 (highest risk) for each of the CN subdivisions to be equipped with PTC. Each risk factor was also assigned a weight, which provided an indication of the "relative importance" of the factor in determining the overall risk ranking. Equation 1 below shows how, for *n* risk factors, a relative risk score was generated for each subdivision by multiplying the integer score assigned to the subdivision for a given factor (FR_i) by the weight assigned to that factor (FW_i), and summing the products of the *n* risk factors.

(Equation 1) $$\textit{Relative Risk Score for Subdivision} = \sum_{i=1}^{n} FR_i FW_i$$

In order to perform the above calculation, the following activities were undertaken:

1) Identify risk factors to be included in the risk prioritization model
2) Estimate risk factor weights (FW_i)
3) Define the risk factor levels (from 0 to 5) that would be used to assign scores to the subdivisions for each risk factor
4) Assign integer scores (FR_i) to each subdivision using the criteria defined in #3 above

Details of each of the activities listed above are provided in the subsections following.

2.1. Identification of Risk Factors

The *Risk Prioritization Template* includes a list of seven risk factors, which it identifies as "minimum critical risk factors that must be addressed" in the risk prioritization model. These seven risk factors, which are listed below, correspond with the risk factors identified in §236.1011(a)(5) as minimum factors that shall be used to determine the sequence in which track segments will be equipped:

1. Annual million gross ton (MGT) levels
2. Presence and volume of passenger traffic
3. Presence and volume of TIH/PIH material (loads and residue) transported
4. Number of tracks
5. Method of operation
6. Speeds of train operations
7. Track grades and curvatures.

CN also considered whether additional risk factors, beyond those identified in the *Risk Prioritization Template*, should be considered for inclusion in the risk prioritization model. While other potential sources for risk were discussed, it was estimated that these other factors would have a negligible effect on risk relative to many of the other risk factors that had already been identified in §236.1011(a)(5) and the *Risk Prioritization Template*.

As shown in Table 2.1 below, a total of 8 discrete risk factors were ultimately included in the model. Table 2.1 contains 1) the risk factors included in the risk prioritization model, 2) the associated risk factor weights, as estimated when taking all of the risk factors in the far left column of the table into account,, and 3) the definition of the range values for each risk factor. The upper part of the table contains the risk factor data from the PTCIP Template while the lower part of the table contains the range values normalized for CN.

In Table 2.1, it can be seen that one of the risk factors identified was decomposed into separate factors. Rather than trying to create a combined 'Track grades and curvatures' risk score for each subdivision and criteria for evaluating these scores, it seemed reasonable, and more transparent, to simply measure a 'Grade' risk factor separate from a 'Curvature' risk factor.

Table 2-1. Identification of Risk Factors Included in CN Risk Prioritization Model

CN Risk Factor Ranges

Risk Factor	Unit	Range Values					
		0	1	2	3	4	5

Notes:

(Redacted Material)

2.2. Estimation of Risk Factor Weights

(Redacted Material)

2.2.1. Review of Previous Applicable Studies and FRA Data

(Redacted Material)

2.2.1.1 Report of the Railroad Safety Advisory Committee: Implementation of Positive Train Control Systems

(Redacted Material)

2.2.1.2 Base Case Risk Assessment: Data Analysis & Tests (Volpe Center)

(Redacted Material)

2.2.1.3 Risk and Train Control: A Framework for Analysis

(Redacted Material)

2.3. Definition of Risk Factor Levels

(Redacted Material)

2.4. Assignment of Risk Factor Levels to Subdivisions

(Redacted Material)

3. Description of Risk Factors and Quantification of Risk Factor Levels and Weights

(Redacted Material)

3.1. Risk Factor #1: Annual Million Gross Ton (MGT) Level

3.1.1. Risk Factor Overview

(Redacted Material)

3.1.2. Quantification of Risk Factor Weight

(Redacted Material)

3.1.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-1. Factor Levels for 'Annual MGT Level'

Factor Level	Lower Limit	Upper Limit

3.2. Risk Factor #2: Presence and Volume of Passenger Traffic

3.2.1. Risk Factor Overview

(Redacted Material)

3.2.2. Quantification of Risk Factor Weight

(Redacted Material)

3.2.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-2. Factor Levels for 'Presence and Volume of Passenger Traffic'

Factor Level	Lower Limit	Upper Limit

3.3. Risk Factor #3: Presence and Volume of Toxic Inhalation Hazard / Poison Inhalation Hazard (TIH/PIH) Material (Loads and Residue) Transported

3.3.1. Risk Factor Overview

(Redacted Material)

3.3.2. Quantification of Risk Factor Weight

(Redacted Material)

3.3.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-3. Factor Levels for 'Presence and Volume of TIH/PIH Materials'

Factor Level	Lower Limit	Upper Limit

3.4. Risk Factor #4: Number of Tracks

3.4.1. Risk Factor Overview

(Redacted Material)

3.4.2. Quantification of Risk Factor Weight

(Redacted Material)

3.4.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-4. Factor Levels for 'Number of Tracks'

Factor Level	Lower Limit	Upper Limit

3.5. Risk Factor #5: Method of Operation

3.5.1. Risk Factor Overview

(Redacted Material)

3.5.2. Quantification of Risk Factor Weight

(Redacted Material)

3.5.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-5. Factor Levels for 'Method of Operation'

Factor Level	Description

3.6. Risk Factor #6: Speed of Train Operations

3.6.1. Risk Factor Overview

(Redacted Material)

3.6.2. Quantification of Risk Factor Weight

(Redacted Material)

3.6.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-6. Factor Levels for 'Speed of Train Operations'

Factor Level	Lower Limit	Upper Limit

3.7. Risk Factor #7: Grade

3.7.1. Risk Factor Overview

(Redacted Material)

3.7.2. Quantification of Risk Factor Weight

(Redacted Material)

3.7.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-7. Factor Levels for 'Grade'

Factor Level	Lower Limit	Upper Limit

3.8. Risk Factor#8: Curvature

3.8.1. Risk Factor Overview

(Redacted Material)

3.8.2. Quantification of Risk Factor Weight

(Redacted Material)

3.8.3. Quantification of Risk Factor Levels

(Redacted Material)

Table 3-8. Factor Levels for 'Curvature'

Factor Level	Lower Limit	Upper Limit

3.9. Other Risk Factors Not Included in the Risk Prioritization Model

(Redacted Material)

4. Model Calculation Tool

Table 4-1. Risk Factor Weighting

Risk Factor	Effect on Probability	Effect on Consequences	Probability Score	Consequence Score	Total Score	Risk Factor Weight

Notes on Risk Factor Rankings:

(Redacted Material)

Risk Factor Weights

Levels	Score

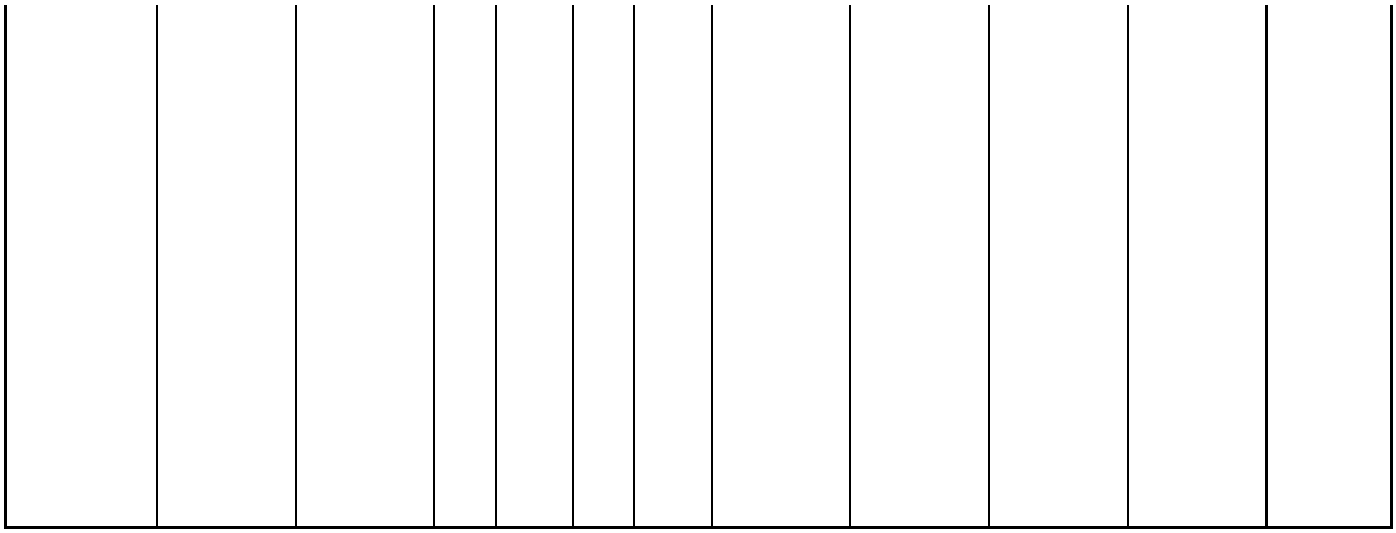
Table 4-2 Risk Factor Ranges

Risk Factor	Unit	Range Values					
		0	1	2	3	4	5

Notes:
(Redacted Material)

Table 4-3 Risk Prioritization Model

	PTC Primary Risk Factor Ratings																	
	1 MGT 2008		2 Passenger		3 TIH 2008		4 Num Trks		5 Meth. Ops		6 Train Speed		7 Grade		8 Curves		9 Summary Weighted Priority
	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	
Subdivision	(0-5)	0.210	(0-5)	0.210	(0-5)	0.200	(1-5)	0.105	(1-5)	0.105	(1-5)	0.110	(1-5)	0.040	(1-5)	0.020	



Risk Factor Weights

Risk Factor Groupings - Based on Total of Risk Factors

Table 4-4: Risk Factor: Annual Million Gross Ton (MGT)

Num	Subdivision	Total Tonnage		MGT		Risk Factor
		2008	2009	2008	2 Yr Avg	

Risk Ranking Ranges

Table 4-5: Risk Factor: Presence and Volume of Passenger Traffic

Num	Subdivision	Daily Amtrak Trains	Daily Commuter Trains	Total Passenger Trains	Risk Factor

Table 4-6: Risk Factor: Presence and Volume of TIH/PIH Material (Loads and Residue) Transported

Num	Subdivision	2008 TIH/PIH Car Counts			Other Hazmat	
		Loads	Residue	Total	Loads & Res.	Risk Factor

TIH Risk Ranking Ranges

Table 4-7: Risk Factor: Number of Tracks

Num	Subdivision	Miles of Main Track				Route Miles	Track Miles	Risk Factor
		Main 1	Main 2	Main 3	Main 4			

Risk Ranking Ranges

Table 4-8: Risk Factor: Method of Operation

Num	Subdivision	Track Miles by Control Method					Route Miles	Track Miles	Risk Factor
		CTC	TWC-ABS	TWC-Dark	YL/520	Total			

Risk Factor Ranking

Table 4-9: Risk Factor: Speed of Train Operations

Num	Subdivision	Max Train Speed (MPH)				Risk Factor Train Speed
		Passenger	Intermodal	Freight	Maximum	

Risk Ranking Ranges

Table 4-10: Risk Factor: Track Grades

Num	Subdivision	Ruling Grade			Risk Factor
		Grade (%)	Milepoint	Ascending Direction	

Risk Ranking Ranges

Table 4-11: Risk Factor: Track Curvatures

Num	Subdivision	Total Curves	Max Curve (Degrees)	Risk Factor

Risk Ranking Ranges

5. Risk Prioritization Model Results

Num	Subdivision	Avg MGT	Peak MGT	TIH/PIH Cars	Passenger Trains/Day	Mainline Route Miles	Risk Factor Group	Weighted Priority

Risk Factor Groupings - Based on Weighted Average of Risk Factors

6. References

[1] Federal Railroad Administration, US Department of Transportation. 49 C.F.R. Parts 229, 234, 235 et al. *Positive Train Control Systems; Final Rule*. Docket No. FRA-2008-0132, Notice No. 3. January 15, 2010.

[2] Federal Railroad Administration, US Department of Transportation. *Risk Prioritization Methodology for PTC System Implementation*, January 7, 2010.

[3] Federal Railroad Administration, US Department of Transportation. *PTC Implementation Plan (PTCIP) Template*, January 7, 2010.

[4] USNRC (United States Nuclear Regulatory Commission) (1990). "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants Final Summary Report," NUREG-1150, (3 vols).

[5] Railroad Safety Advisory Committee (RSAC), Federal Railroad Administration, US Department of Transportation. *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems*. September 1999.

[6] Railroad Systems Division (DTS-75), Office of Safety and Security, The John Volpe National Transportation Systems Center, US Department of Transportation. *Presentation for Office of Safety, Federal Railroad Administration RSAC/PTC Working Group Risk 2 Team, Base Case Risk Assessment: Data Analysis & Tests*. April 22, 2003.

[7] Carl D. Martland, Ying Zhu, Youssef Lahrech, and Joseph M. Sussman. *Risk and Train Control: A Framework for Analysis*. Center for Transportation Studies, Massachusetts Institute of Technology, Cambridge, January 2001.

[8] Congress of the United States. *Rail Safety Improvement Act of 2008*. Public Law 110–432. October 16, 2008.

[9] Federal Railroad Administration, US Department of Transportation. 49 C.F.R. Parts 209, 234, and 236, *Standards for Development and Use of Processor-Based Signal and Train Control Systems;* Final Rule. Docket No. FRA-2001-10160. March 7, 2005.

[10] Federal Railroad Administration, US Department of Transportation. *Signals and Train Control Fact Sheet.* October 2008.

[11] Federal Transit Administration, US Department of Transportation. *Commuter Rail Safety Study*. November 2006.

[12] Richard F. Healing, Member of National Transportation Safety Board, and Chairman of the Board of Inquiry. *Opening Statement in Public Hearing on Collision of Union Pacific Railroad Freight Train MHOTU-23 and BNSF Railway Company Freight Train MEAPTUL-126D, Macdona, Texas*. April 26-27, 2005. http://www.ntsb.gov/events/2005/Macdona/opening.htm

[13] American Railway Engineering and Maintenance-of-Way Association, *Practical Guide to Railway Engineering*. AREMA 2003.

[14] Saat R. and Barkan C., University of Illinois. *Positive Train Control Toxic Inhalation Hazard Risk Analysis Methodology* Presentation. January 27, 2010.

[15] Federal Railroad Administration, Office of Safety Analysis. *Accident Data (1998 through 2008).* http://safetydata.fra.dot.gov/officeofsafety/. Data downloaded on February 21, 2010.

[16] Transport Canada, U.S. Department of Transportation, Secretariat of Transport and Communications of Mexico (SCT) et al. *2008 Emergency Response Guidebook.*

Appendix C: Review of Previous Applicable Studies

(Redacted Material)

Appendix D: Interoperability Letters of Understanding

Letter of Understanding
Implementation of Positive Train Control

Date: March 16, 2010

This Letter of Understanding is by and between National Railroad Passenger Corporation (Amtrak) and Illinois Central Railroad Company · Grand Trunk Western Railroad Company

WHEREAS, in accordance with the Rail Safety Improvement Act of 2008, 49 USC §20157(a)(1), "each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation shall develop and submit to the Secretary of Transportation a plan for implementing a positive train control system by December 31, 2015...," and

WHEREAS, each host railroad, as defined in 49 CFR §236.1003, is required to file a Positive Train Control Implementation Plan (PTCIP) with the Federal Railroad Administration in accordance with 49 CFR §236.1011, and

WHEREAS, in accordance with 49 CFR §236.1011(a)(3), the PTCIP must state "How the PTC system will provide for interoperability of the system between the host and all tenant railroads on the track segments required to be equipped with PTC systems under this subpart..."

NOW THEREFORE, the parties set forth their mutual understanding:

1. The parties will seek to implement PTC in a manner that meets all requirements of the law, including technical and other requirements of interoperability, as that term is defined in 49 CFR §236.1003(b).

2. The parties intend to participate in a PTC testing program to verify functionality and interoperability.

3. The parties will facilitate the exchange of technical and other information needed to implement PTC in accordance applicable law, including 49 CFR §236.1001 et seq.

4. This Letter of Understanding does not modify or supplant any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed this Letter of Understanding as of the date set forth above.

National Railroad Passenger Corporation

By: _____

Name: William L. Crosbie

Title: Chief Operating Officer

Agency/Carrier

By: Paul E Ladue

Name: Paul E. Ladue

Title: Region Director Contracts & Administration

Letter of Understanding
Implementation of Positive Train Control

Date: March 22, 2010

This Letter of Understanding by and between the Commuter Rail Division of the Regional Transportation Authority, the Northern Illinois Regional Commuter Railroad Corporation a division of an Illinois municipal corporation and an Illinois public corporation, respectively, (collectively, **Metra**), with offices at 547 West Jackson Boulevard, Chicago, IL 60661 and the Wisconsin Central Ltd and Illinois Central Railroad Company, (collectively, **CN**) with offices at 17641 South Ashland Avenue, Homewood, IL, 60430,

WITNESSETH THAT

WHEREAS, in accordance with the Rail Safety Improvement Act of 2008, 49 USC §20157(a)(1), "each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation shall develop and submit to the Secretary of Transportation a plan for implementing a positive train control system by December 31, 2015," and

WHEREAS, each host railroad, as defined in 49 CFR §236.1003, is required to file a Positive Train Control Implementation Plan (**PTCIP**) with the Federal Railroad Administration in accordance with §236.1011, and

WHEREAS, in accordance with §236.1011(a)(3) the PTCIP must state "How the PTC system will provide for interoperability of the system between the host and all tenant railroads on the track segments required to be equipped with PTC systems under this subpart,"

NOW THEREFORE, the parties set forth their mutual understanding:

1. Both parties seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).

2. Both parties desire to participate in a PTC testing program to verify functionality and interoperability.

3. The parties will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

4. This Letter of Understanding does not modify or supplant any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed this document as of the day and year first written above.

METRA:

Philip A. Pagano, Executive Director

Wisconsin Central Ltd
Illinois Central Railroad Company:

Paul E. Ladue, Region Director Contracts & Admin

Letter of Understanding
Implementation of Positive Train Control

Date: 28 JULY 2010

This Letter of Understanding by and between Union Pacific Railroad, with offices at 1400 Douglas Street, Omaha, NE 68179 (UPRR) and Canadian National Railway Company (CN) with offices at 935 de la Gauchetiere Street West, Montreal, Quebec, Canada,

WITNESSETH THAT

WHEREAS, in accordance with the Rail Safety Improvement act of 2008, 49 USC §20157(a)(1), "each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation shall develop and submit to the Secretary of Transportation a plan for implementing a positive train control system by December 31, 2015," and

WHEREAS, each host railroad as defined in 49 CFR §236.1003 is required to file a Positive Train Control Implementation Plan (PTCIP) with the Federal Railroad Administration in accordance with §236.1011, and

WHEREAS, in accordance with §236.1011(a)(3) the PTCIP must state "How the PTC system will provide for interoperability of the system between the host and all tenant railroads on the track segments required to be equipped with PTC systems under this subpart,"

NOW THEREFORE, the parties set forth their mutual understanding:

1. Both parties seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).

2. Both parties desire to participate in a PTC testing program to verify functionality and interoperability.

3. The parties will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements

4. This Letter of Understanding does not modify or supplant any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

UNION PACIFIC RAILROAD

Thomas J. Hurst

Title:
VP Operating Systems & Practices

Rev. 2/13/10

CANADIAN NATIONAL RAIWAY COMPANY

D Tays

Dwight Tays
Chief – Engineering Technology

MEMORANDUM OF UNDERSTANDING
IMPLEMENTATION OF POSITIVE TRAIN CONTROL

Date: 05 April 2010

This MEMORANDUM OF UNDERSTANDING is hereby made and entered into by and between Canadian National Railway Company hereinafter referred to as CN, and Consolidated Rail Corporation Shared Assets Organization, hereinafter referred to as CSAO

A. PURPOSE:

In accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), CSAO will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and CSAO's operating and safety rules. CSAO is preparing its PTC Implementation Plan (PTCIP), required by the regulations to be submitted on or before April 16, 2010. As per 236.1013(a)(3), the PTCIP CSAO submits must describe how interoperability with all tenant railroads will be achieved on line segments where PTC is deployed; it has been determined your operations on CSAO include areas where PTC will be deployed. This is a MEMORANDUM OF UNDERSTANDING between CSAO and CN to obtain an interoperable PTC solution.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

1. Both parties seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b).
2. CSAO is planning to deploy the V-ETMS PTC system which is designed to support interoperability. V-ETMS is a locomotive centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.
3. CSAO is planning on utilizing 220 MHz spectrum for PTC communication functions of radios and wayside interface units.
4. Both parties desire to participate in a PTC testing program to verify functionality and interoperability.
5. The parties will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.
6. This Memorandum of Understanding does not modify or supersede any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

Consolidated Rail Corporation Shared Assets Organization

By:
Name: T. C. Tierney
Title: Vice President/Chief Engineer
Address: 1000 Howard Boulevard
Mount Laurel, NJ 08054

By:
Name:
Title:
Address:

MEMORANDUM OF UNDERSTANDING
IMPLEMENTATION OF POSITIVE TRAIN CONTROL

Date: **19 March 2010**

This MEMORANDUM OF UNDERSTANDING is hereby made and entered into by and between Canadian National Railway Company hereinafter referred to as CN, and **Norfolk Southern Railway Company**, hereinafter referred to as **NSR**.

A. **PURPOSE:**

In accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), NSR will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and NSR's operating and safety rules. NSR is preparing its PTC Implementation Plan (PTCIP), required by the regulations to be submitted on or before April 16, 2010. As per §236.1011(a)(3), the PTCIP NSR submits must describe how interoperability with all tenant railroads will be achieved on line segments where PTC is deployed; it has been determined your operations on NSR include areas where PTC will be deployed. This is a MEMORANDUM OF UNDERSTANDING between NSR and CN to obtain an interoperable PTC solution.

B. **STATEMENT OF MUTUAL BENEFIT AND INTERESTS:**

1. Both parties seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b).

2. NSR is planning to deploy the Wabtec V-ETMS PTC system which is designed to support interoperability. V-ETMS is a locomotive-centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.

3. NSR is planning on utilizing 220 MHz spectrum for PTC communication functions of radios and wayside interface units.

4. Both parties desire to participate in a PTC testing program to verify functionality and interoperability.

5. The parties will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

6. This Memorandum of Understanding does not modify or supersede any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

Norfolk Southern Railway Company
By: Lisa Wilson
Name: Lisa C. Wilson
Title: Manager ATCS Regulatory Compliance & Training
Address: 1200 Peachtree Street, NE, Box 123
Atlanta, GA 30309

Agency/Carrier
By: D Toys
Name: Dwight Toys
Title: Chief - Engineering Technology
Address: 10229 - 127th Ave
Floor 2, Building "R"
Edmonton, Alberta, Canada
T5E 0B9

Letter of Understanding
Implementation of Positive Train Control

Date: 01 April 2010

This Letter of Understanding by and between Canadian Pacific Railway Company (CP), with offices at 401 9th Ave. S.W., Calgary, Alberta, Canada and Canadian National Railway Company (CN) with offices at 935 de La Gauchetiere Street West, Montreal, Quebec,

WITNESSETH THAT

WHEREAS, in accordance with the Rail Safety Improvement act of 2008, 49 USC §20157(a)(1), "each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation shall develop and submit to the Secretary of Transportation a plan for implementing a positive train control system by December 31, 2015," and

WHEREAS, each host railroad as defined in 49 CFR §236.1003 is required to file a Positive Train Control Implementation Plan (PTCIP) with the Federal Railroad Administration in accordance with §236.1011, and

WHEREAS, in accordance with §236.1011(a)(3) the PTCIP must state "How the PTC system will provide for interoperability of the system between the host and all tenant railroads on the track segments required to be equipped with PTC systems under this subpart,"

NOW THEREFORE, given that each party is both host and tenant, the parties set forth their mutual understanding:

1. Both parties seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).

2. Both parties desire to participate in a PTC testing program to verify functionality and interoperability.

3. The parties will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements

4. This Letter of Understanding does not modify or supplant any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

CANADIAN PACIFIC RAILWAY

By: _____

Name CHRIS CARROLL

Title: DIRECTOR, OPERATIONS - PTC

CANADIAN NATIONAL RAILWAY

By _____

Name Dwight Toys

Title: Chief - Engineering Technology

Rev. 3/11/10

Letter of Understanding
Implementation of Positive Train Control

Date: 01 APRIL 2010

This Letter of Understanding is by and between The Kansas City Southern Railway Company and

Canadian National Railway Company (agency or carrier),

WHEREAS, in accordance with the Rail Safety Improvement act of 2008,49 USC §20157(a)(1), "each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation shall develop and submit to the Secretary of Transportation a plan for implementing a positive train control system by December 31, 2015/' and

WHEREAS, each host railroad, as defined in 49 CFR §236.1003, is required to file a Positive Train Control Implementation Plan (PTCIP) with the Federal Railroad Administration in accordance with §236.1011, and

WHEREAS, in accordance with §236.1011(a)(3) the PTCIP must state "How the PTC system will provide for interoperability of the system between the host and all tenant railroads on the track segments required to be equipped with PTC systems under this subpart..."

NOW THEREFORE, the parties set forth their mutual understanding:

1. The parties will seek to implement PTC in a manner that meets all requirements of the law, including technical and other requirements of interoperability, as that term is defined in 49 CFR §236.1003(b).

2. The parties intend to participate in a PTC testing program to verify functionality and interoperability.

3. The parties will facilitate the exchange of technical and other information needed to implement PTC in accordance applicable law, including 49 CFR §236.1001 et seq.

4. This Letter of Understanding does not modify or supplant any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed this Letter of Understanding as of the date set forth above.

THE KANSAS CITY SOUTHERN RAILWAY COMPANY

By

Richard W. Stones
Name

AVP Advanced Systems Planning
Title

Agency/Carrier

By

Dwight Tays
Name

Chief - Engineering Technology
Title

Letter of Understanding
Implementation of Positive Train Control

Date: 14 April 2010

This Letter of Understanding is by and between BNSF Railway Company and Canadian National Railway Company (agency or carrier),

WHEREAS, in accordance with the Rail Safety Improvement act of 2008, 49 USC §20157(a)(1), "each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation shall develop and submit to the Secretary of Transportation a plan for implementing a positive train control system by December 31, 2015," and

WHEREAS, each host railroad, as defined in 49 CFR §236.1003, is required to file a Positive Train Control Implementation Plan (PTCIP) with the Federal Railroad Administration in accordance with §236.1011, and

WHEREAS, in accordance with §236.1011(a)(3) the PTCIP must state "How the PTC system will provide for interoperability of the system between the host and all tenant railroads on the track segments required to be equipped with PTC systems under this subpart,"

NOW THEREFORE, the parties set forth their mutual understanding:

1. Both parties seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).

2. Both parties desire to participate in a PTC testing program to verify functionality and interoperability.

3. The parties will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements

4. This Letter of Understanding does not modify or supplant any existing agreement between the parties.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

BNSF RAILWAY COMPANY	**AGENCY/CARRIER**
D J Galassi	D Toys
By	**By**
David J. Galassi	Dwight Toys
Name	**Name**
AVP Netowrk Control Systems	Chief - Engineering Technology
Title	**Title**

Rev.3/09/10

MEMORANDUM OF UNDERSTANDING
Implementation of Positive Train Control

Date: April 13, 2010

This Letter of Understanding is hereby made and entered into by and between CSX Transportation, Inc., with offices at 500 Water Street, Jacksonville, Florida 32202 (hereinafter referred to as "CSXT") and Canadian National Railway Company (agency or carrier) with offices at 935 de La Gauchetiere St. West Montreal, QC, Canada (hereinafter collectively referred to as "Railroads").

A. PURPOSE:

In accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), CSXT will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and CSXT's operating and safety rules. CSXT is preparing its PTC Implementation Plan (PTCIP), required by the regulations to be submitted on or before April 16, 2010. In accordance with §236.1011(a)(3), the PTCIP CSXT submits must describe how interoperability will be achieved with all tenant railroads will be achieved on line segments where PTC is deployed. It has been determined your operations on CSXT include areas where PTC will be deployed. This is a Memorandum of Understanding between CSXT and Canadian National Railway Company to obtain an interoperable PTC solution on the identified line segments.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

1. Railroads seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b).

2. CSXT is planning to deploy the Wabtec V-ETMS PTC system which is designed to support interoperability. V-ETMS is a locomotive-centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.

3. CSXT is planning on utilizing 220 MHz spectrum for communication functions of radios and wayside interface units.

4. Railroads desire to participate in a PTC testing program to verify functionality and interoperability.

5. Railroads will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

6. This Memorandum of Understanding does not modify or supersede any existing agreement among Railroads.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

CSX Transportation, Inc.	AGENCY/CARRIER
By:	By:
Timothy K. Male	Dwight Toys
Name:	Name:
AVP Advanced Engineering	Chief - Engineering Technology
Title:	Title:

Rev. 3/29/10

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